Allen-Bradley

LPM20 Liquid-Cooled Adjustable Frequency AC Drive

With High Performance Drive Control

Installation Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at **http://www.rockwellautomation.com/literature**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc. is prohibited.

Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid the hazard, and recognize the consequences.

Shock Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

Burn Hazard labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be at dangerous temperatures.

Allen-Bradley, PLC, DriveExplorer, DriveExecutive, DriveLogix, SCANport, and SynchLink are either registered trademarks or trademarks of Rockwell Automation, Inc.

The information below summarizes the changes to this manual since the last release (July 2005):

Description of Changes	Page
In Table 1.A, changed column heading from “Output Current at 2 kHz (Amps)” to “Output Current at 4 kHz (Amps).” Changed the last sentence in footnote 2 from “…also capable of running at 3 kHz or 4 kHz…” to “…also capable of running at 2 kHz or 3 kHz.”	1-1
Changed Table 3.A columns and information.	3-7
Deleted Table 3.B, and added replacement fuses subheading and reference to the drive wiring diagram.	3-7
In the“Control” category specifications section for the “Carrier Frequency,” changed the statement “Drive rating based on 2 kHz” to “Drive rating based on 4 kHz.”	A-2

The information below summarizes the changes to this manual since the last release (January 2005):

Description of Changes	Page
Deleted Chapter 3 - Programming and Parameters. The active converter information formerly contained in Chapter 3 is now contained in the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…), which is referenced in the Preface.	P-1
Changed the following catalog string information: • In Digits 4 through 7 (Input Voltage & Output Current Rating), deleted Cat. Code D405. Also removed all “405A” drive information from Table 1.A, Table 1.B, Table 1.C, Table 3A, Table 3B, and the VFD Power Module Table on page C-11. • In Digit 12 (Input Filter Items), deleted Cat. Code C.	P-5
Added a reference to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…) for more information about active converter communication.	1-33
Added a reference to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…) for more information about wiring the active converter control board I/O terminals.	1-34
Re-numbered Chapter 4 - Troubleshooting to be Chapter 3.	Chapter 3
Added a reference to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…) for active converter fault descriptions and related troubleshooting information.	3-3
In Table 3.B, changed replacement Voltage Feedback Resistor Assembly, 460 V kit number from “180924-A03” to “180923-A03.”	—

Table of Contents

Preface — **Overview**

Who Should Use this Manual? P-1
What Is Not in this Manual P-1
Reference Materials P-2
Manual Conventions P-3
General Precautions P-4
Catalog Number Explanation P-5

Chapter 1 — **Installation/Wiring**

Power Ratings 1-1
Enclosure Ratings 1-2
Drive Component Locations 1-2
AC Supply Source Considerations 1-11
Mounting the Drive, Determining Wire Routing, and Grounding 1-12
Coolant Considerations 1-14
Installing Input Power Wiring 1-17
Installing Output Power Wiring 1-19
Power Wiring. 1-20
Using Input/Output Contactors 1-22
I/O Wiring 1-23
Main Control Board I/O and Encoder Settings 1-31
Connecting SynchLink 1-32
Active Converter Communication. 1-33
Auto Tune Operation. 1-33
Pre-charge Operation. 1-34
Wiring the Active Converter Control Board I/O Terminals 1-34
CE Conformity 1-36
C-Tick Conformity 1-37

Chapter 2 — **Start Up**

Prepare For Drive Start-Up 2-1
Status Indicators 2-3
Assisted Start Up. 2-4

Chapter 3 — **Troubleshooting**

Faults and Alarms 3-1
Drive Status 3-2
Manually Clearing Drive Faults 3-3
Drive Fault Descriptions 3-3
Active Converter Fault Descriptions 3-3
Clearing Drive Alarms 3-3
Common Symptoms and Corrective Actions 3-4
Test Equipment Needed To Troubleshoot 3-6
Verifying That DC Bus Capacitors Are Discharged 3-6
Replacement Parts 3-7

Appendix A — **Supplemental Drive Information**

Specifications A-1
Communication Configurations A-3

Appendix B HIM Overview

Remote HIM Connection B-1
LCD Display Elements B-2
ALT Functions B-2
Menu Structure B-3
Viewing and Editing Parameters B-5
Removing/Installing the HIM B-6

Appendix C Wiring Diagrams

Drive C-2
Power Module – Overall C-4
Power Module – Active Converter Control and Rectifier Power Interface C-6
Power Module – High Voltage Interconnect and Inverter Power Interface C-8
Power Module – Rectifier IGBT and Inverter IGBT C-10

Index

Overview

The purpose of this manual is to provide you with the basic information needed to install and troubleshoot the LPM20 Liquid-Cooled AC Drive with High Performance Drive Control.

For information on ...	See page ...
Who Should Use this Manual?	P-1
What Is Not in this Manual	P-1
Reference Materials	P-2
Manual Conventions	P-3
General Precautions	P-4
Catalog Number Explanation	P-5

Who Should Use this Manual?

This manual is intended for qualified personnel. You must be able to mount and wire Adjustable Frequency AC Drive devices.

What Is Not in this Manual

This manual is designed to provide only installation, wiring, and troubleshooting information.

PowerFlex 700 Active Converter Power Module Information

LPM20 Liquid-Cooled Adjustable Frequency AC Drives are equipped with a PowerFlex 700 Active Converter Power Module. For details on active converter I/O wiring, start-up, programming, and other related information, please refer to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…).

PowerFlex 700S Phase II Control Information

LPM20 Liquid-Cooled Adjustable Frequency AC Drives are equipped with a PowerFlex 700S Phase II control cassette. Please refer to the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual* (Publication No. 20D-UM006…) in the locations shown in parenthesis below for information on:

- Start-up (Chapter 2).
- Drive programming and parameters (Chapter 3).
- Application notes (Appendix C).

Reference Materials

Publications can be obtained online at http://www.rockwellautomation.com/literature.

The following manuals are recommended for general drive information :

Title	Publication
Wiring and Grounding Guidelines for Pulse Width Modulated (PWM) AC Drives	DRIVES-IN001...
Preventive Maintenance of Industrial Control and Drive System Equipment	DRIVES-TD001…
Safety Guidelines for the Application, Installation and Maintenance of Solid State Control	SGI-1.1
A Global Reference Guide for Reading Schematic Diagrams	0100-2.10
Guarding Against Electrostatic Damage	8000-4.5.2

The following publications provide specific feedback card information:

Title	Publication
Hi-Resolution (Stegmann) Feedback Option Card Installation Instructions for PowerFlex 700S Drives (also LPM20 with High Performance Drive Control)	20D-IN001 …
Resolver Feedback Option Card Installation Instructions for PowerFlex 700S Drives (also LPM20 with High Performance Drive Control)	20D-IN002 …
Multi-Device Interface Option Card Installation Instructions for PowerFlex 700S Drives (also LPM20 with High Performance Drive Control)	20D-IN004 …

The following publication provides information that is necessary when applying the 700S Phase II Control DriveLogix™5730 Controller:

Title	Publication
DriveLogix™5730 Controller User Manual	20D-UM003 …

The following publications provide information that is useful when planning and installing communication networks:

Title	Publication
ControlNet Coax Tap Installation Instructions	1786-5.7
ControlNet Cable System Planning and Installation Manual	1786-6.2.1
ControlNet Fiber Media Planning and Installation Guide	CNET-IN001 …
SynchLink™ Design Guide	1756-TD008 …

For Allen-Bradley Drives Technical Support:

E-mail: support@drives.ra.rockwell.com
Tel: (1) 262.512.8176
Fax (1) 262.512.2222
Online: www.ab.com/support/abdrives

Manual Conventions

- In this manual we refer to the LPM20 Liquid-Cooled AC Drive as; drive, LPM20 or LPM20 Drive.
- To help differentiate parameter names and LCD display text from other text, the following conventions will be used:
  - Parameter Names will appear in [brackets].
    For example: [DC Bus Voltage].
  - Display Text will appear in “quotes.” For example: “Enabled.”
- The following words are used throughout the manual to describe an action:

Word	Meaning
Can	Possible, able to do something
Cannot	Not possible, not able to do something
May	Permitted, allowed
Must	Unavoidable, you must do this
Shall	Required and necessary
Should	Recommended
Should Not	Not recommended

General Precautions

Class 1 LED Product

ATTENTION: Risk of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber optic cable connectors.

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, “Guarding Against Electrostatic Damage” or any other applicable ESD protection handbook.

ATTENTION: An incorrectly applied or installed drive can result in component damage or a reduction in product life. Wiring or application errors, such as, undersizing the motor, incorrect or inadequate AC supply, or excessive ambient temperatures may result in malfunction of the system.

ATTENTION: Only qualified personnel familiar with adjustable frequency AC drives and associated machinery should plan or implement the installation, start-up, and subsequent maintenance of the system. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: To avoid an electric shock hazard, verify that the voltage on the bus capacitors has discharged before performing any work on the drive. After removing power to the drive, wait 5 minutes for the bus capacitors to discharge. Measure the DC bus voltage at the locations shown in Figure 3.2. The voltage must be zero.

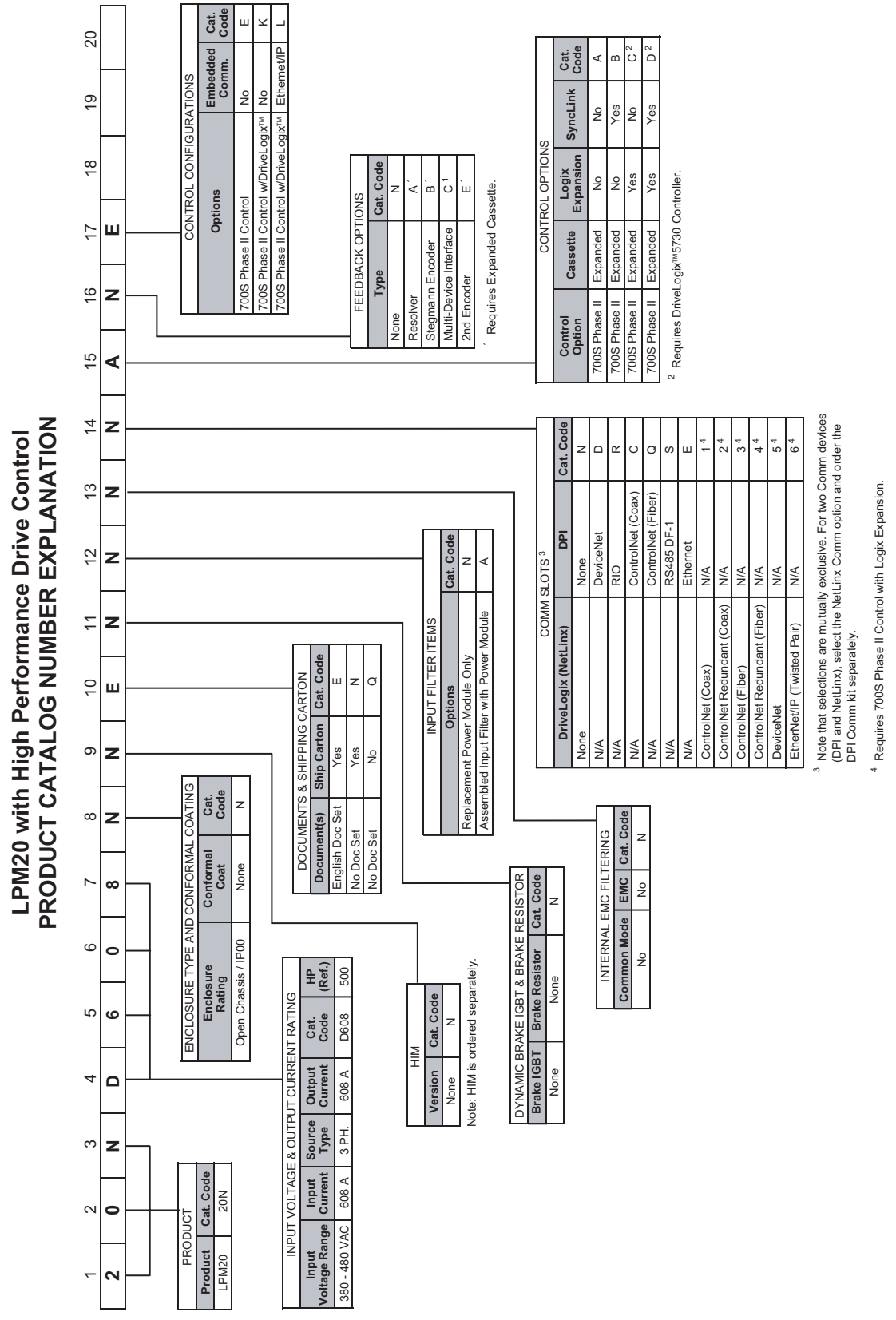
ATTENTION: Risk of injury or equipment damage exists. DPI or SCANport™ host products must not be directly connected together via 1202 cables. Unpredictable behavior can result if two or more devices are connected in this manner.

ATTENTION: Risk of injury or equipment damage exists. Parameters 365 [Fdbk LsCnfg Pri] - 394 [VoltFdbkLossCnfg] let you determine the action of the drive in response to operating anomalies. Precautions should be taken to ensure that the settings of these parameters do not create hazards of injury or equipment damage.

ATTENTION: Risk of injury or equipment damage exists. Parameters 383 [SL CommLoss Data] - 392 [NetLoss DPI Cnfg] let you determine the action of the drive if communications are disrupted. You can set these parameters so that the drive continues to run. Precautions should be taken to ensure that the settings of these parameters do not create hazards of injury or equipment damage.

Catalog Number Explanation

The LPM20 with High Performance Drive Control catalog numbering scheme is shown below.


LPM20 with High Performance Drive Control
PRODUCT CATALOG NUMBER EXPLANATION
1 2 0 N D 6 0 8 N N E N N N A N E
PRODUCT
Product | Cat. Code
LPM20 | 20N
INPUT VOLTAGE & OUTPUT CURRENT RATING
Input Voltage Range | Input Current | Source Type | Output Current | Cat. Code | HP (Ref.)
380 - 480 VAC | 608 A | 3 PH. | 608 A | D608 | 500
ENCLOSURE TYPE AND CONFORMAL COATING
Enclosure Rating | Conformal Coat | Cat. Code
Open Chassis / IP00 | None | N
DOCUMENTS & SHIPPING CARTON
Document(s) | Ship Carton | Cat. Code
English Doc Set | Yes | E
No Doc Set | Yes | N
No Doc Set | No | Q
HIM
Version | Cat. Code
None | N
Note: HIM is ordered separately.
INPUT FILTER ITEMS
Options | Cat. Code
Replacement Power Module Only | N
Assembled Input Filter with Power Module | A
DYNAMIC BRAKE IGBT & BRAKE RESISTOR
Brake IGBT | Brake Resistor | Cat. Code
None | None | N
INTERNAL EMC FILTERING
Common Mode | EMC | Cat. Code
No | No | N
COMM SLOTS 3
DriveLogix (NetLinx) | DPI | Cat. Code
None | None | N
N/A | DeviceNet | D
N/A | RIO | R
N/A | ControlNet (Coax) | C
N/A | ControlNet (Fiber) | Q
N/A | RS485 DF-1 | S
N/A | Ethernet | E
ControlNet (Coax) | N/A | 1 4
ControlNet Redundant (Coax) | N/A | 2 4
ControlNet (Fiber) | N/A | 3 4
ControlNet Redundant (Fiber) | N/A | 4 4
DeviceNet | N/A | 5 4
EtherNet/IP (Twisted Pair) | N/A | 6 4
3 Note that selections are mutually exclusive. For two Comm devices (DPI and NetLinx), select the NetLinx Comm option and order the DPI Comm kit separately.
4 Requires 700S Phase II Control with Logix Expansion.
CONTROL CONFIGURATIONS
Options | Embedded Comm. | Cat. Code
700S Phase II Control | No | E
700S Phase II Control w/DriveLogix™ | No | K
700S Phase II Control w/DriveLogix™ | EtherNet/IP | L
FEEDBACK OPTIONS
Type | Cat. Code
None | N
Resolver | A 1
Stegmann Encoder | B 1
Multi-Device Interface | C 1
2nd Encoder | E 1
1 Requires Expanded Cassette.
CONTROL OPTIONS
Control Option | Cassette | Logix Expansion | SyncLink | Cat. Code
700S Phase II | Expanded | No | No | A
700S Phase II | Expanded | No | Yes | B
700S Phase II | Expanded | Yes | No | C 2
700S Phase II | Expanded | Yes | Yes | D 2
2 Requires DriveLogix™5730 Controller.

Notes:

Installation/Wiring

This chapter provides information on mounting and wiring the LPM20 Drive.

For information on ...	See page ...
Power Ratings	1-1
Enclosure Ratings	1-2
Drive Component Locations	1-2
AC Supply Source Considerations	1-11
Mounting the Drive, Determining Wire Routing, and Grounding	1-12
Coolant Considerations	1-14
Installing Input Power Wiring	1-17
Installing Output Power Wiring	1-19
Power Wiring	1-20
Using Input/Output Contactors	1-22
I/O Wiring	1-23
Main Control Board I/O and Encoder Settings	1-31
Connecting SynchLink	1-32
Active Converter Communication	1-33
Auto Tune Operation	1-33
Pre-charge Operation	1-34
Wiring the Active Converter Control Board I/O Terminals	1-34
CE Conformity	1-36
C-Tick Conformity	1-37

Most start-up difficulties are the result of incorrect wiring. Every precaution must be taken to assure that the wiring is done as instructed. All items must be read and understood before the actual installation begins.

ATTENTION: The following information is merely a guide for proper installation. The Allen-Bradley Company cannot assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Power Ratings

LPM20 Drives with High Performance Drive Control have power ratings as described in Table 1.A below:

Table 1.A Power Ratings (1)

Catalog Number (positions 1-7 only)	Input Power (KVA)	Input Voltage (V)	Input Current (Amps)	Output Current at 4 kHz (2) (Amps)	HP Ratings	Full Load Power Loss Watts Fluid/Air
20ND608	505	380 to 480	608	608	500	9000/3000

(1) 110% output current capability for one minute, 150% output current capability for 5 seconds.

(2) Note that LPM20 drives are rated for use with water at specified temperatures and pressures as the coolant. Some coolant fluids may allow an increased output rating while others may require the output to be derated. LPM20 drives are also capable of running at 2 kHz or 3 kHz.

Enclosure Ratings

LPM20 drives have the following enclosure rating:

- Open-Chassis Style: Intended to be installed in an enclosure.

LPM20 drives must be placed in an enclosure.

Drive Component Locations

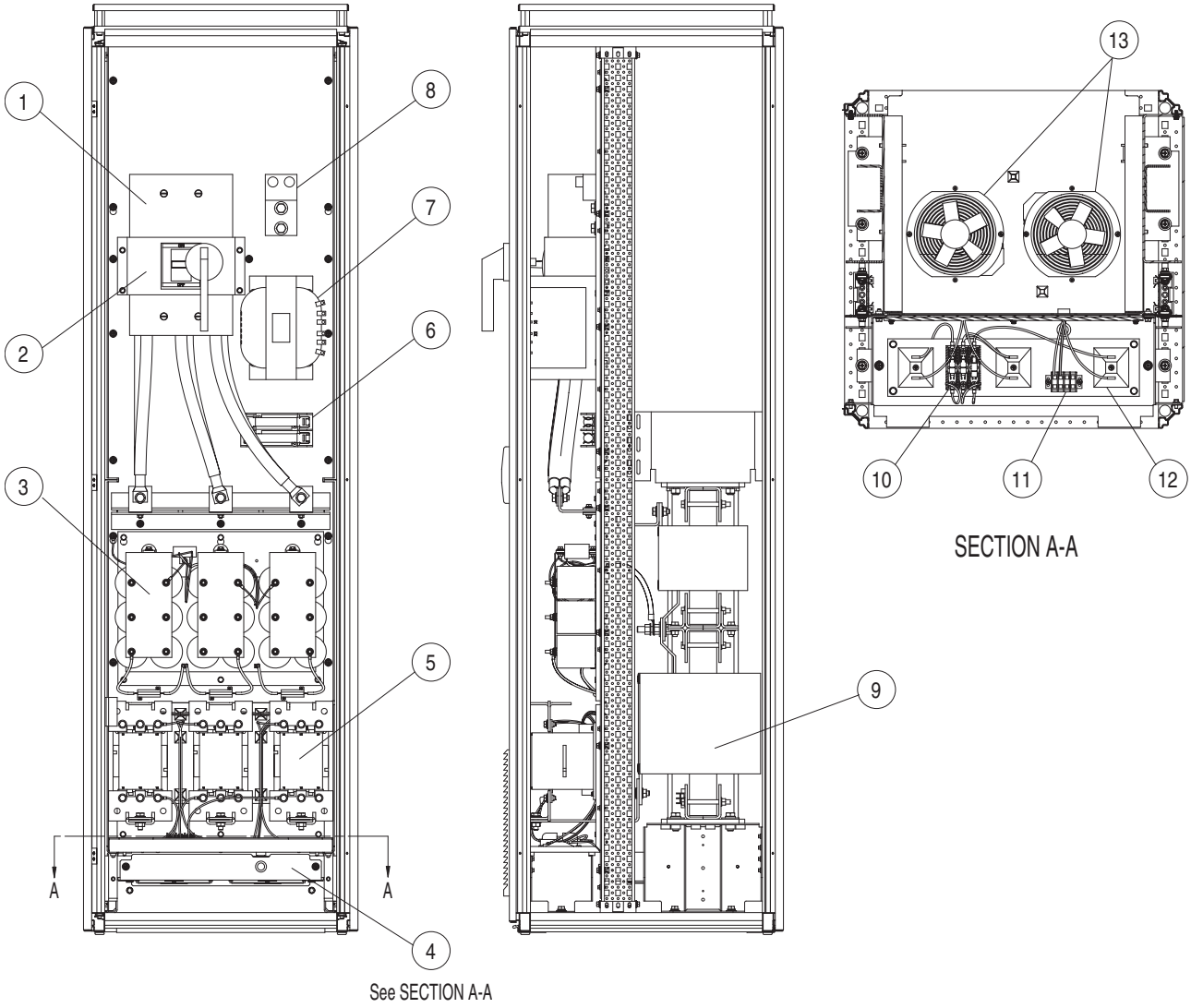
LPM20 Liquid-Cooled AC drives with High Performance Drive Control are comprised of an input components section and a power module section.

Drive Input Component Locations

The input components section contains the following main components. The numbered items listed below correspond to the numbers used in Figure 1.1. Replacement parts are listed in Chapter 3.

1. Main Circuit Breaker
2. Circuit Breaker Operating Mechanism
3. Capacitor Bank Filter
4. Fan Tray
5. Precharge AC Contactors (3)
6. Fuses, 15A, Primary Control Transformer (2)
7. Control Transformer, 120 VAC, 1 Phase, 3 KVA
8. Ground Lug, 2-600 MCM
9. Inductor
10. Fuses, Precharge Resistors, 20A, 600V (3)
11. Terminal Block, 4-Position
12. Precharge Resistors (3)
13. 115V Fans (2)

Figure 1.1 Drive Input Components



Power Module Component Locations

The power module section contains the following main components. The numbered items listed below correspond to the numbers used in Figure 1.2 and Figure 1.3. Replacement parts are listed in Chapter 3.

1. Cable Assembly, 40-pin, 0.050 in. Pitch, Flex Film (1)
2. Cable Assembly, 30-pin, 0.050 in. Pitch, Flex Film (1)
3. Cable Assembly, 40-pin, 0.050 in. Pitch, Flex Film (1)
4. Wire Harness Assembly, Power Supply, Upper Gate (2)
5. Inverter Power Interface Assembly
6. Wire Harness Assembly, Power Supply, Lower Gate, PF700S (1)
7. 80 W Power Supply Assembly (2)
8. Insulation Sheet (2)
9. Cable Assembly, 40-pin, 0.050 in. Pitch, Flex Film (1)
10. Cable Assembly, 30-pin, 0.050 in. Pitch, Flex Film (1)
11. Wire Harness Assembly, Power Supply, Logic (2)
12. Wire Harness Assembly, Power Supply, Lower Gate (1)
13. Rectifier Power Interface Assembly
14. Current Feedback Device, 1000A (6)
15. Wire Harness Assembly, Gate Driver
16. Wire Harness Assembly, Current Feedback Device
17. Wire Harness Assembly, Input Filter (1)
18. Wire Harness Assembly, DC Bus Bleeder Resistors (1)
19. High Voltage Interconnect Assembly (1)
20. PF700S Voltage Feedback, 400V Class, Assembly (1)
21. Terminal Block, 2-Position (1)
22. Cable Assembly, 10-Position, Ribbon (1)
23. PF700S Control Cassette
24. Active Converter Assembly
25. Connector, Terminal Block, 15-pin
26. Connector, Terminal Block, 7-pin
27. Voltage Feedback Resistor, 460V, Assembly
28. Internal Fan
29. Communications Interface Assembly
30. Cable Assembly, 20-pin, 0.050 in. Pitch, Flex Film (optional)
31. Communications Module (optional)

Figure 1.2 Power Module Component Locations – Door Open

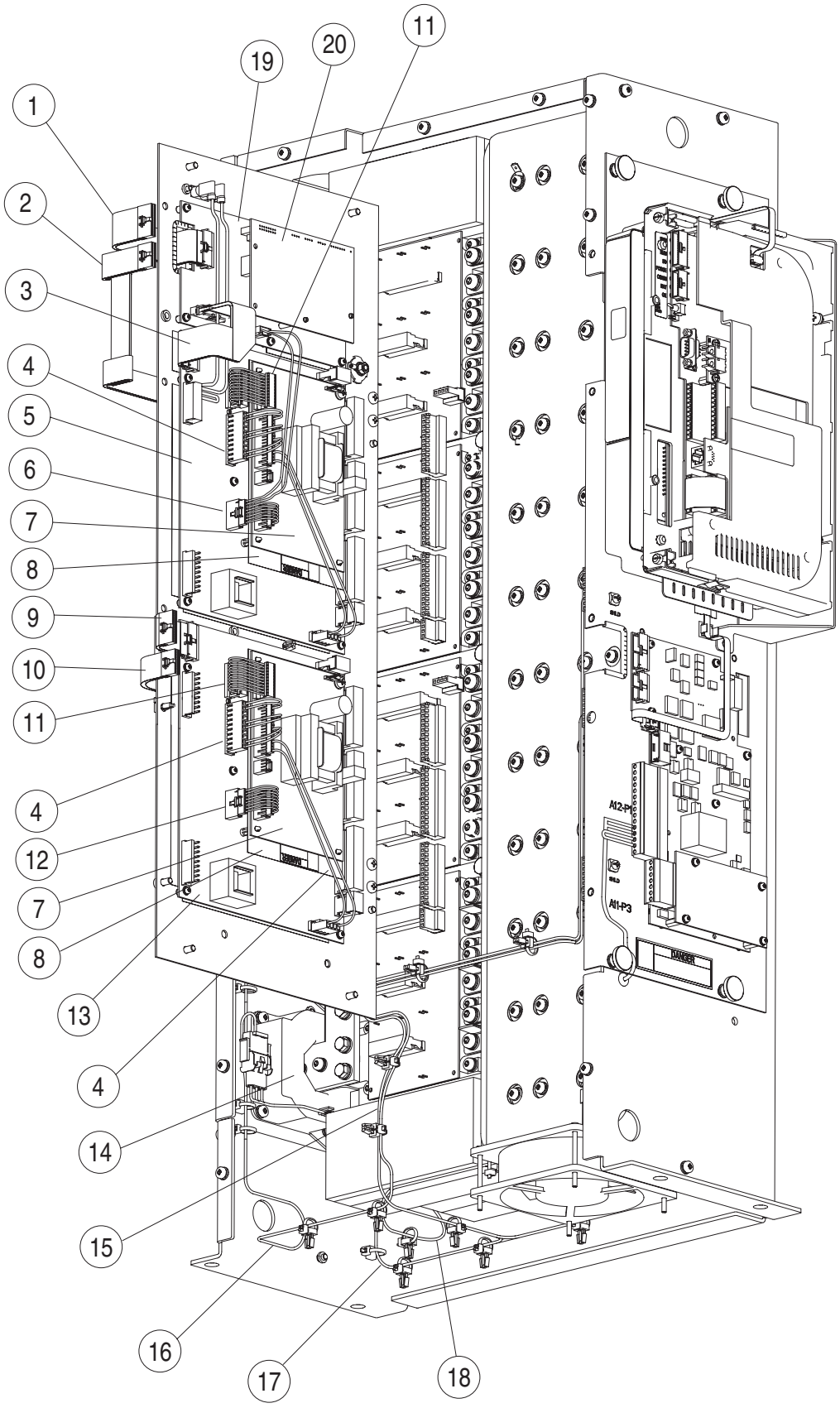
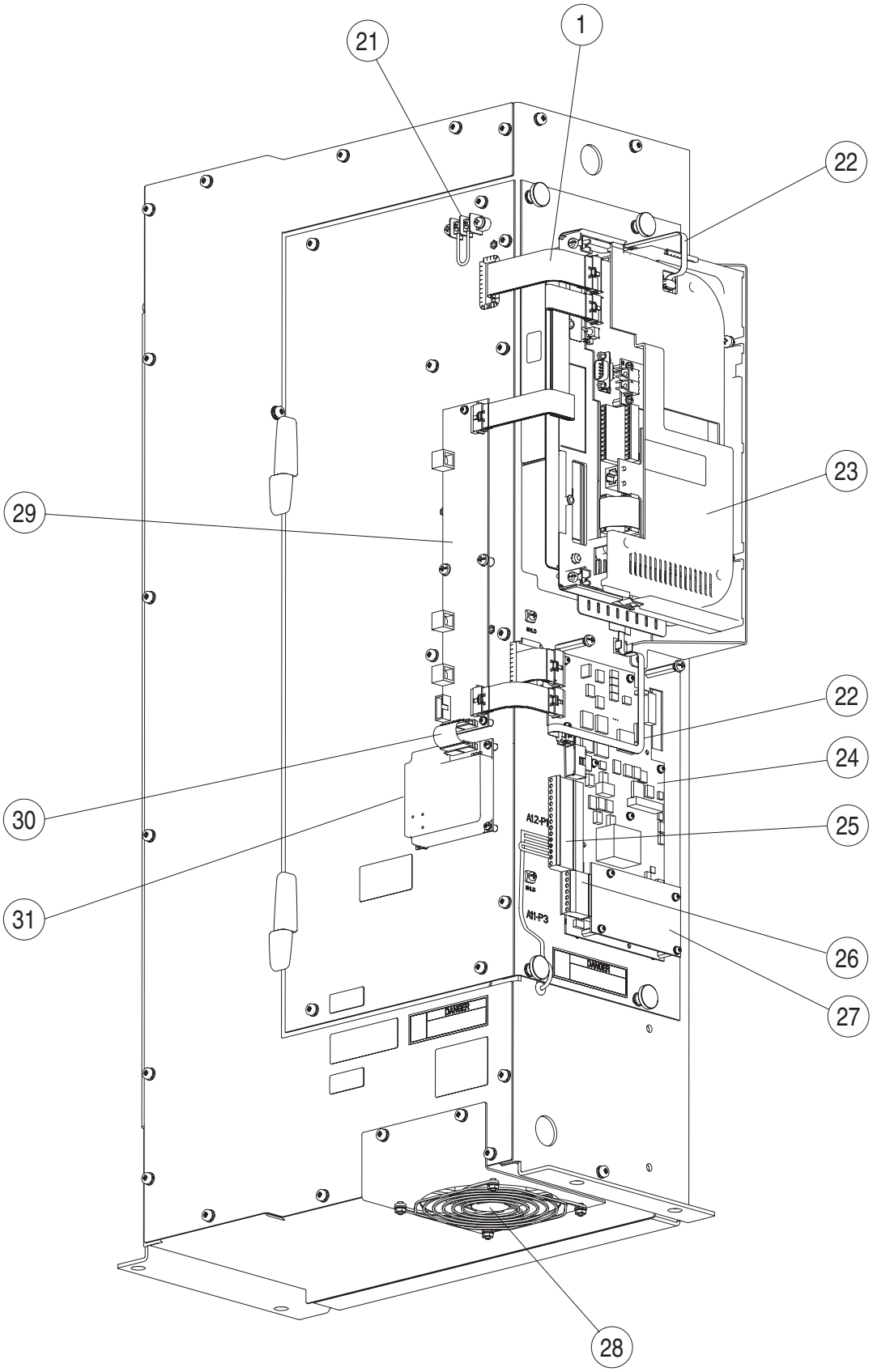


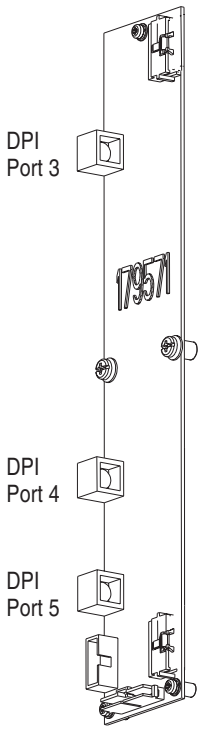
Figure 1.3 Power Module Component Locations – Door Closed



DPI Communication Port

The Communication Interface PCB contains an eight-position, female, locking mini-DIN connector that is used as a DPI communication port. This port (DPI Port 4 shown in Figure 1.4 below) provides communication between the LPM20 drive and another DPI device (for example, a HIM).

Figure 1.4 DPI Communication Interface Board

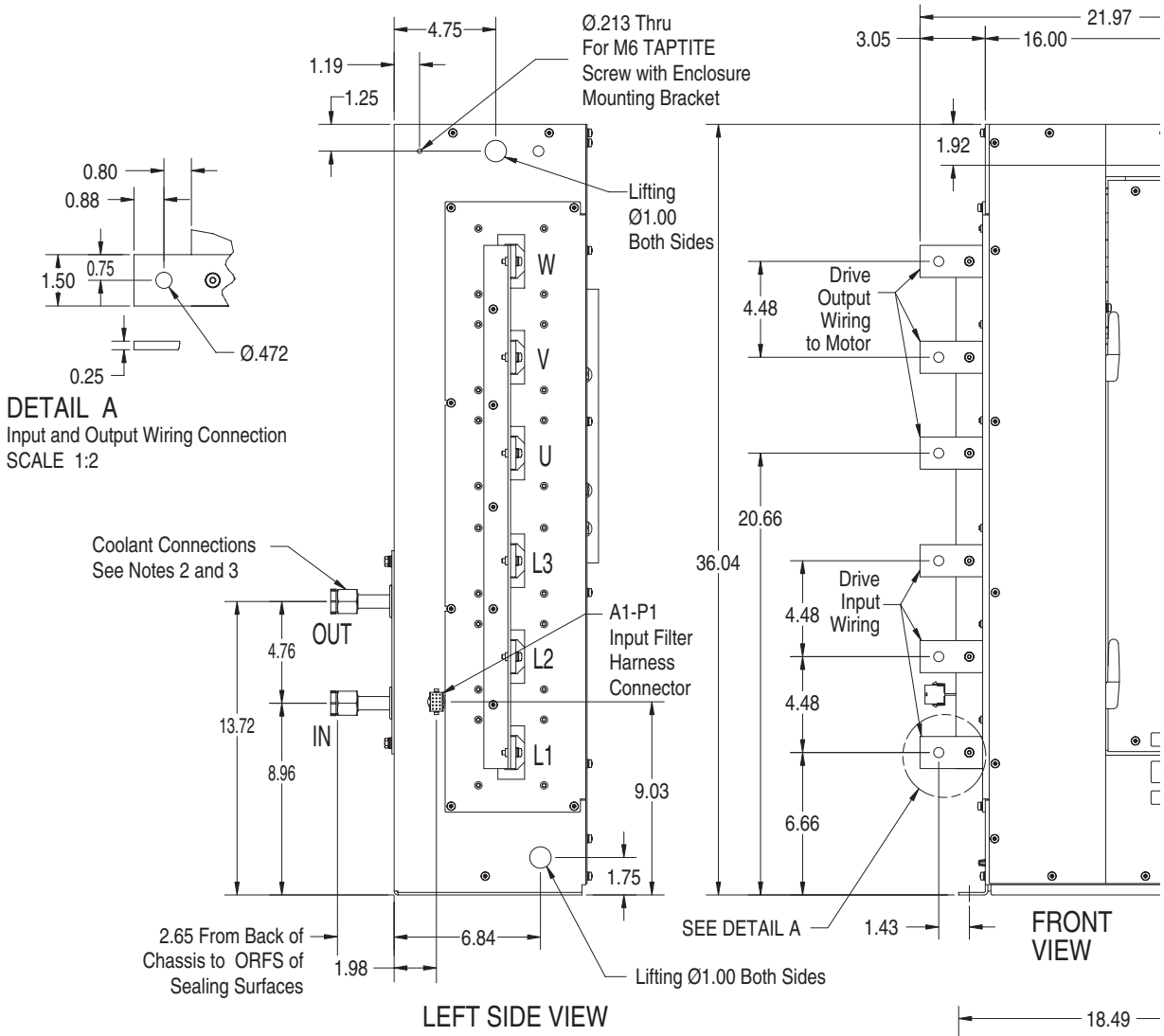


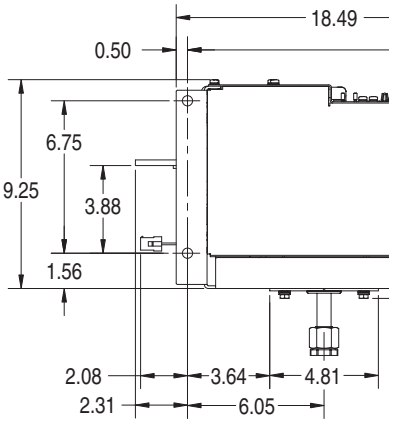
For more information regarding operating LPM20 drives with a HIM, refer to Appendix B.

Determining Total Area Required Based on Drive Dimensions

Overall drive dimensions are illustrated in Figure 1.5 and Figure 1.6 as an aid in calculating the total area required by the LPM20 drives.

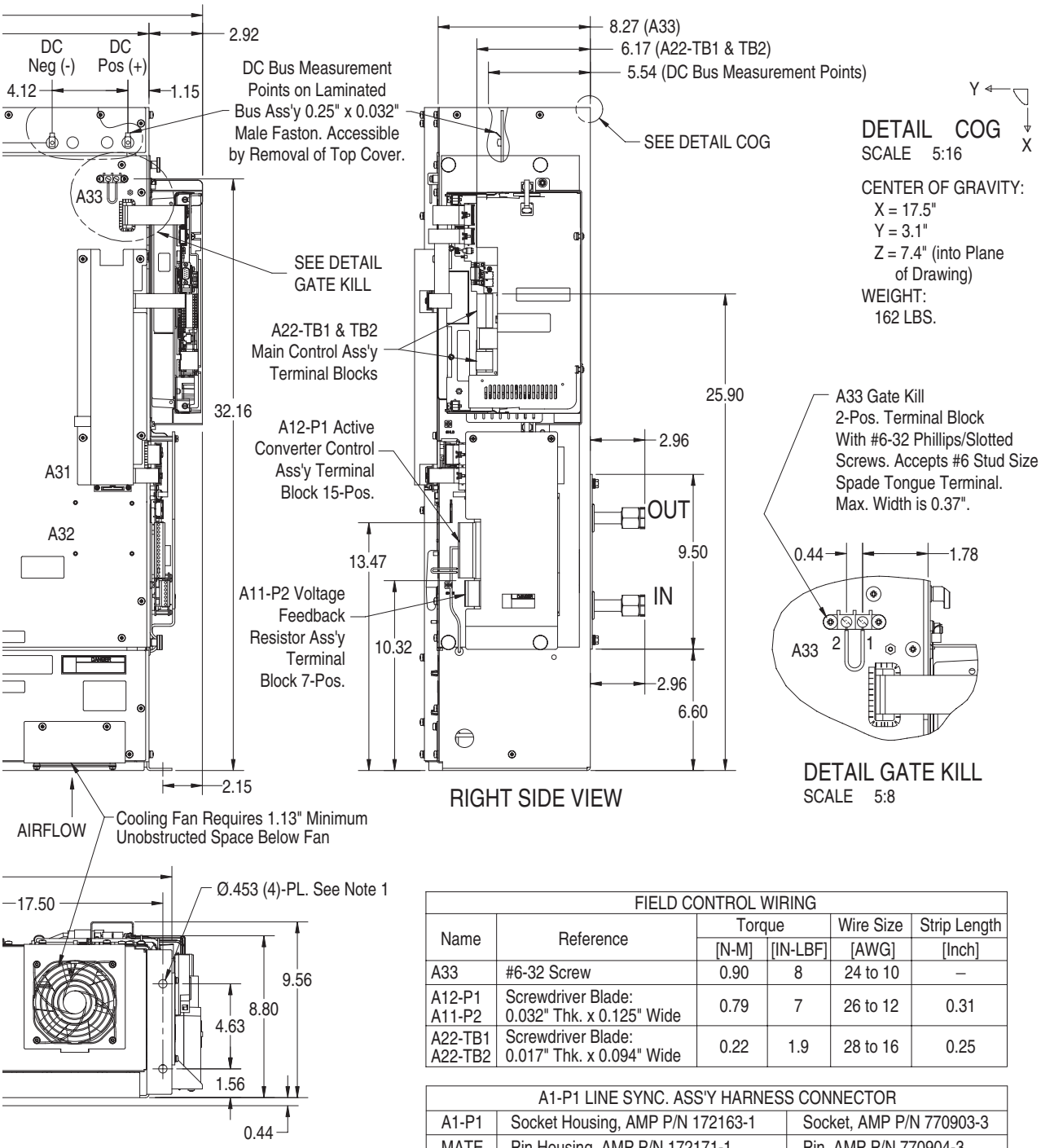
Figure 1.5 Power Module Dimensions and Mounting





NOTES:

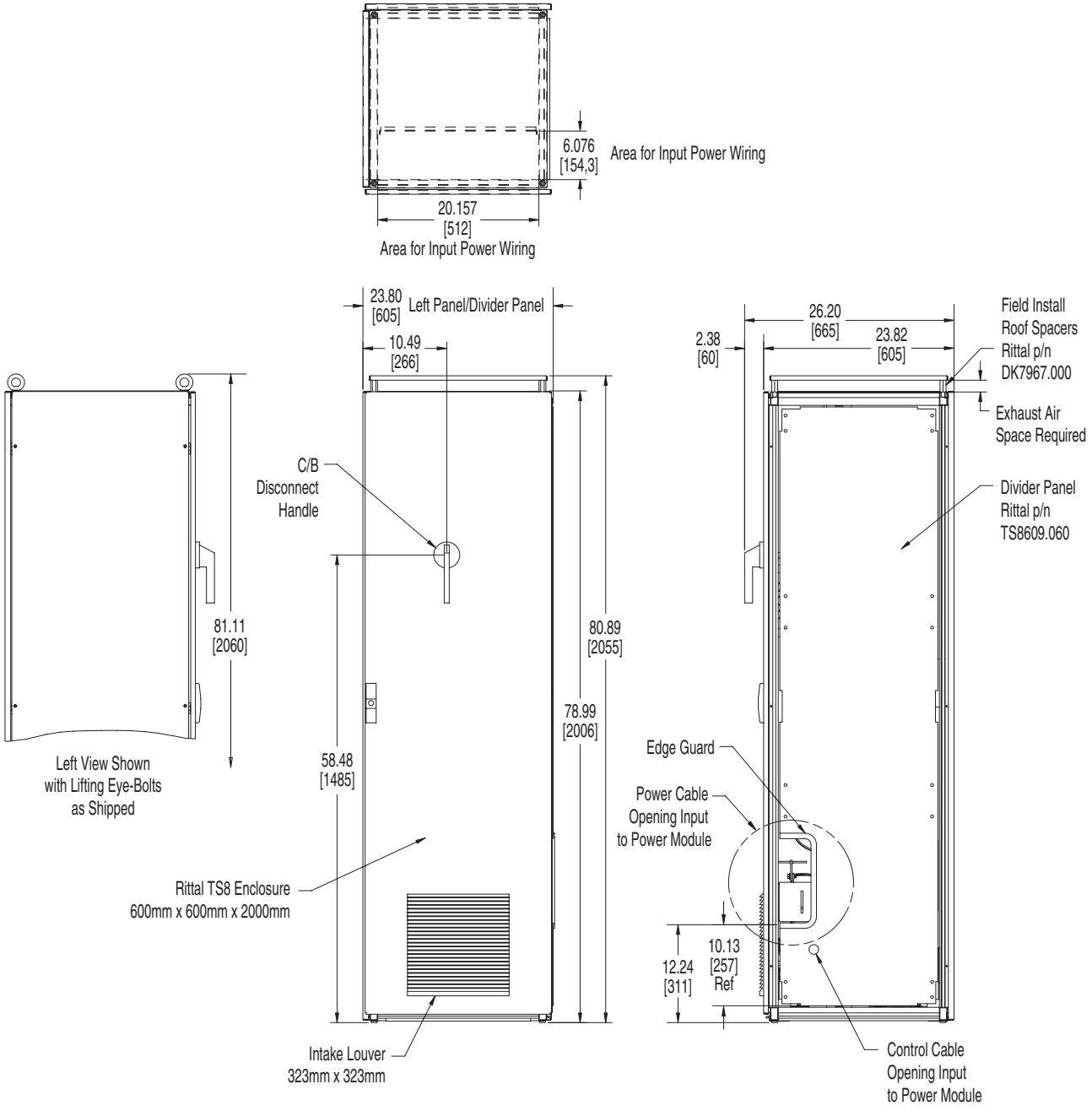
1. Floor Mounting Flange Holes:
   A. Accept M8 Thread-Rolling Screws per SAE J1237.
   B. Tightening Torque: 20-24 [N-M], 15-17 [FT-LBF].
2. Inlet and Outlet Coolant Connection Hardware Provided With Unit:
   A. ORFS Braze Sleeve:
      a. Material: Brass; for 5/8" O.D. Copper Tube.
      b. Reference: Parker Hannifin P/N 10 TL-B, or equivalent.
   B. ORFS Nut:
      a. Material: Brass; for 5/8" O.D. Copper Tube, 1-14 UN/UNF-2B Thread.
      b. Tightening Torque: 37-45 [N-M], 27.1-33.3 [FT-LBF].
      c. Reference: Parker Hannifin P/N 10 BL-B, or equivalent.
3. Coolant Connection Hardware Provided by User:
   A. ORFS Braze Adapter:
      a. Material: Brass; for 5/8" O.D. Copper Tube, 1-14 UN/UNF-2A Thread.
      b. Reference: Parker Hannifin P/N 10 LHB3-B, or equivalent.
   B. ORFS O-Ring:
      a. Material: Neoprene Rubber.
      b. Size: 0.614 I.D., 0.070 Width.
      c. Reference: Parker Hannifin P/N 2-016-C0873-70, or equivalent.
   C. O-Ring Lubricant: Parker Hannifin Super-O-Lube, or equivalent.



FIELD CONTROL WIRING					
Name	Reference	Torque		Wire Size	Strip Length
		[N-M]	[IN-LBF]	[AWG]	[Inch]
A33	#6-32 Screw	0.90	8	24 to 10	–
A12-P1 A11-P2	Screwdriver Blade: 0.032" Thk. x 0.125" Wide	0.79	7	26 to 12	0.31
A22-TB1 A22-TB2	Screwdriver Blade: 0.017" Thk. x 0.094" Wide	0.22	1.9	28 to 16	0.25

A1-P1 LINE SYNC. ASS'Y HARNESS CONNECTOR		
A1-P1	Socket Housing, AMP P/N 172163-1	Socket, AMP P/N 770903-3
MATE	Pin Housing, AMP P/N 172171-1	Pin, AMP P/N 770904-3

Figure 1.6 Drive Input Dimensions



Verifying that Site Provides for Recommended Air Flow Clearances

Be sure there is adequate clearance for air circulation around the user-supplied enclosure. A 6-inch minimum clearance is required wherever vents are located in the cabinet.

For proper cabinet ventilation, roof spacers must be field installed as shown in Figure 1.6.

Verifying Power Module Input Ratings Match Supplied Power

It is important to verify that plant power will meet the input power requirements of the LPM20 drive's Power Module circuitry. See Table 1.A for input power rating specifications. Be sure input power to the drive corresponds to the drive nameplate voltage and frequency.

AC Supply Source Considerations

LPM20 drives are suitable for use on a circuit capable of delivering up to a maximum of 100,000 rms symmetrical amperes, and a maximum of 480 volts. A circuit breaker with shunt trip as supplied with input drive components with the appropriate kAIC rating must always be used upstream of the power module.

ATTENTION: To guard against personal injury and/or equipment damage caused by improper circuit breaker selection, use only the recommended circuit breakers specified in Table 1.B.

Unbalanced or Ungrounded Distribution Systems

LPM20 drives should not be used with a supply system that is ungrounded and when the phase-to-phase voltage exceeds 125% of normal line-to-line voltage.

ATTENTION: LPM20 drives contain protective MOVs on the drive's printed circuit boards. The MOVs are referenced to ground. The MOVs should not be disconnected.

Input Power Conditioning

Certain events on the power system supplying a drive can cause component damage or shortened product life. They are:

- The power system has power factor correction capacitors switched in and out of the system, either by the user or by the power company.
- The power source has intermittent voltage spikes in excess of 6000 volts. These spikes could be caused by other equipment on the line or by events such as lightning strikes.
- The power source has frequent interruptions.

Wiring Requirements for the Drive

Certain drive requirements should be checked before continuing with the drive installation. Wire sizes, branch circuit protection, encoder feedback (for FVC regulation), and wiring to disable the drive are all areas that need to be evaluated.

Operation of the drive can be disabled in two locations. Gate Kill terminal block (A33) on the front of the power structure can be used to disable the firing of inverter IGBTs. When the connection between terminals 1 and 2 is opened, inverter IGBTs are disabled independent of any software control. This action also generates fault 207 in the inverter to enunciate this

condition. As a result of this fault, the active converter is also turned off, but this is done via software operation. The firing of IGBTs in the active converter can be disabled independently of any software control by opening the connection between terminals 13 and 14 on the active converter control assembly terminal block A12-P1. This action also genrates a fault in the inverter to enunciate this condition. Wiring diagrams are shown in Figure 1.5 and on page C-3.

Input Line Branch Circuit Protection

ATTENTION: Most codes require that upstream branch circuit protection be provided to protect input power wiring. The circuit breaker values provided in the Drive Input Components are listed in Table 1.B.

Table 1.B AC Input Circuit Breaker Values

LPM20 Drive Catalog Number (positions 1-7 only)	Input Voltage	Circuit Breaker Provided
20ND608	380-480 VAC	800 A

Note: One 120 VAC shunt trip to be installed as shown in the drive wiring diagram on page C-2.

Mounting the Drive, Determining Wire Routing, and Grounding

This section shows how to mount the drive and properly ground it. Also described is the wiring to be routed in and out of the drive.

Lifting and Mounting the Power Module

Use the following procedure to lift the LPM20 power module and mount it in the required enclosure:

1. Install two s-hooks into the power module to serve as lifting points. Two 1-inch through holes are provided in the sheet metal chassis.
2. Connect 18 inches (nominal) of chain between the s-hooks and secure them with a clevis clamp.
3. Using an overhead or portable hoist (minimum 1/2-ton rated capacity), attach a free-fall chain to the chain secured to the drive. Take up any vertical slack in the chain.
4. Using the hoist, lift the power module from the horizontal shipping pallet.
5. Position the power module in the enclosure.
6. In order to maintain a flat mounting surface and to ensure that bolt tightness is maintained, use flat washers and split-ring lock washers under the bolt heads. Refer to Figure 1.5 for power module mounting dimensions.
7. Remove the s-hooks and chain.

Verifying the Drive's Watts Loss Rating

When mounting the drive inside of an enclosure, you should determine the watts loss rating of the drive from Table 1.A. This table lists the typical full load power loss watts value at 2 kHz (rated carrier frequency). Ensure that the enclosure is adequately ventilated with 0° to 40° C ambient air based on the drive's watts loss rating.

Determining Input, Motor Output, Ground, and Control Wire Routing for the Drive

All wiring should be installed in conformance with the applicable local, national, and international codes (e.g., NEC/CEC). Signal wiring, control wiring, and power wiring must be routed in separate conduits to prevent interference with drive operation. Use grommets, when hubs are not provided, to guard against wire chafing. Figure 1.5 and Figure 1.6 show the wire routing, grounding terminal, and power terminal strips of LPM20 drives with High Performance Drive Control.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

Grounding the Drive

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Use the following steps to ground the drive:

1. Open the door of the enclosure.

2. Run a suitable equipment grounding conductor unbroken from the drive to the motor's ground terminal and then to earth ground. Use one of the bolts that pass through the drive baseplate and are used to fasten the drive to the wall or cabinet. See Figure 1.6. Tighten these grounding connections to the proper torque as shown in Table 1.D.
3. Connect a suitable grounding conductor to the motor frame and the remote control station (if used). Run each conductor unbroken to earth ground. When adding more than one grounding conductor wire to a single chassis ground, twist the conductors together. Tighten these grounding connections to the proper torque as shown in Table 1.D.
4. Close the door of the enclosure.

Coolant Considerations

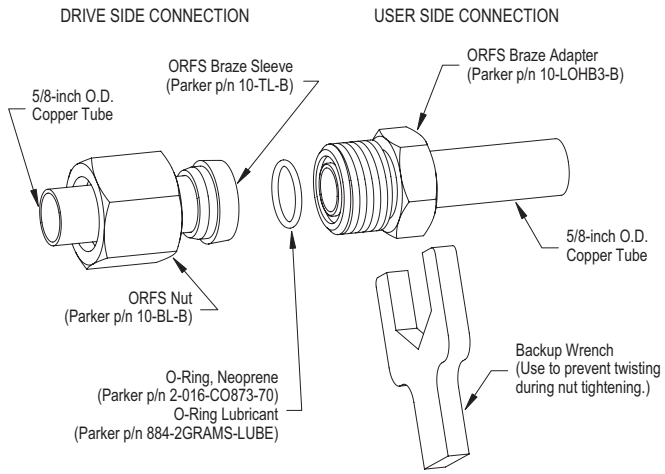
LPM20 drives use o-ring face seal fittings for connection to the coolant supply. The coolant is typically clean water with a corrosion inhibitor as described in this section.

LPM20 drive coolant connections are made with o-ring face seal fittings. The copper tube running from the heatsink to the o-ring fittings is covered with closed cell foam insulation.

The mating connection is shown in Figure 1.7. The mating process includes the following steps:

1. Coat the o-ring with the o-ring lubricant. The goal is a thin film covering the entire o-ring surface. Avoid excess globs of lubricant.
2. Insert the o-ring into the o-ring groove in the external thread-side fitting on the user side. Avoid any twisting of the o-ring.
3. Assemble the fittings and tighten to a torque of 37 to 45 N-m (or 27 to 33 lb.-ft.). Use a backup wrench on the user side fitting to avoid twisting the drive side tubing.

Figure 1.7 Mating Connection



Other recommendations include:

1. The allowable coolant temperature range is 0°C to 40°C (32°F to 105°F). When using coolant at a temperature below the dew point of the surrounding air, condensation could accumulate on the drive heatsink and/or circuit boards and damage the drive. In this situation, install a coolant flow regulating device and tube/hose insulation. A flow regulating device modulates the coolant flow rate to a level that permits the drive heatsink temperature to rise above the dew point. Insulation for customer side tube or hose may be closed-cell foam insulation with minimum 1/2-inch wall thickness.
2. Install a flow switch after the coolant outlet connection to shutoff the drive if coolant flow drops below 4 gpm.
3. Circulate water through the drive only when the drive is also powered. Failure to do this may result in condensation accumulating on the drive heatsink and/or circuit boards, which could damage the drive.
4. For applications requiring a closed loop coolant system, ensure the system is vented to remove air that would otherwise degrade the performance of the drive heatsink.

Coolant Connections

LPM20 drives with High Performance Drive Control have inlet and outlet connections as shown in Figure 1.5. Tube assemblies with O-ring fittings are bolted to the heatsink.

The rated working pressure of the drive is 185 psig. Coolant supply and return lines should be sized for 10 gpm/185 psig service with a maximum operating temperature of 40°C (105°F). The required operating flow rate and pressure drop is specified in Table 1.C.

Coolant Requirements

LPM20 drives are rated for use with coolant consisting of clean water with a corrosion inhibitor. Deionized water is prohibited. Use distilled water or water with the following concentrations:

- Less than 50 ppm of sulfate and chloride.
- Less than 50 ppm of hard water ions such as Mg++ and Ca++.

Coolant must be properly strained and/or filtered to ensure it is free of contamination.

The coolant must be compatible with the following materials: Copper, brass, aluminum, and neoprene.

Table 1.C Coolant Requirements for LPM20 Drives

LPM20 Drive Catalog Number (positions 1-7 only)	Max. Output Current (Amps)	Coolant Temperature Range (°C)	Minimum Coolant Flowrate (GPM)	Pressure Drop From Drive Inlet to Drive Outlet (PSIG) at Minimum Coolant Flow Rate	Coolant Type
20ND608	608	5 to 40	7	10	Water (1)
	608	0 to 40	7	10	WEG25 (2)
	550	0 to 40	7	10	WEG50 (3)
	608	0 to 40	10	22	WEG50 (3)
	608	0 to 30	7	10	WEG50 (3)

(1) Water equals good quality or distilled water with Chemtool, Inc. corrosion inhibitor, 2% inhibitor by volume.

(2) WEG25 equals good quality or distilled water with approved ethylene glycol, 25% glycol by volume.

(3) WEG50 equals good quality or distilled water with approved ethylene glycol, 50% glycol by volume.

Corrosion Inhibitor

A corrosion inhibitor is required. The following two options are approved sources:

1. Chemtool, Inc. (www.chemtool.com) part number Watertool 4435-C. The recommended concentration of the inhibitor is 8 to 10% by volume.
2. Dow Chemical (www.dow.com) Dowtherm® SR-1 inhibited ethylene glycol. The recommended concentration of the inhibitor is 25% by volume.

Dowtherm is a registered trademark of the Dow Chemical Company.

ATTENTION: Ethylene glycol must be inhibited and silicate free. Use of common silicate-containing, automotive-type ethylene glycol solutions is prohibited as they may damage the drive and cooling module equipment.

Biocide

A biocide may be needed to control biological growth. Use of a biocide is permitted. For specific recommendations, consult a reputable water treatment company.

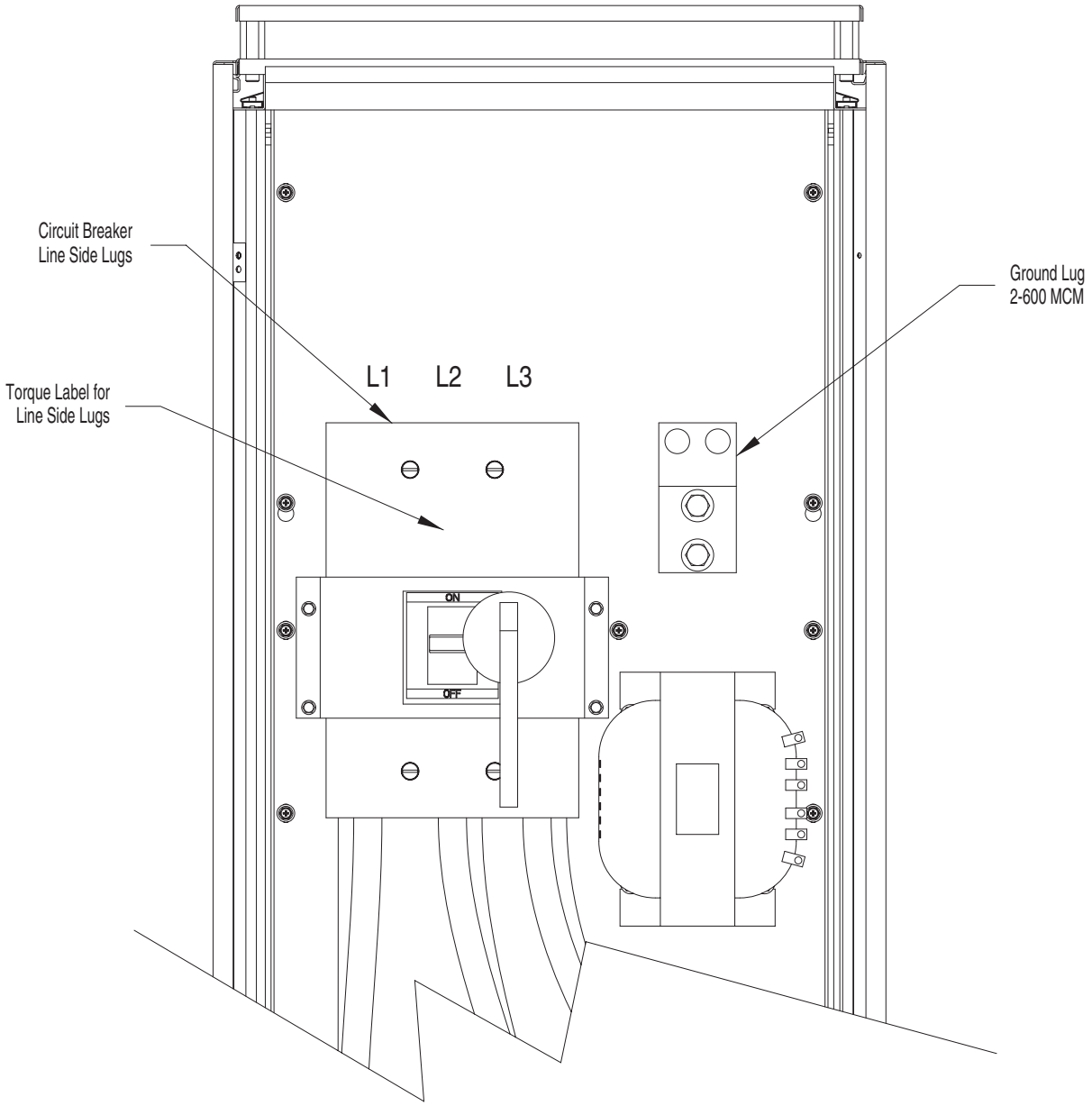
Installing Input Power Wiring

This section describes incoming line components and how to install them.

Installing Transformers and Reactors (Not Recommended)

The LPM20 AC drive may be used on distribution systems with 100,000 amps or less symmetrical fault current capacity. The Drive Input components consists of a 3% line reactor and a harmonic line filter. Additional input inductance is not recommended.

Figure 1.8 Drive Input Wiring



NOTE: Proper torque for Line Side Lugs is labeled on the circuit breaker.

Installing a Required External/Separate Input Disconnect

An input disconnect must be installed in the line before the drive input terminals in accordance with local, national, and international codes (e.g., NEC/CEC). The disconnect should be sized according to the in-rush current as well as any additional loads the disconnect might supply. The trip rating for the inrush current (10-12 times full load current) should be coordinated with that of the input isolation transformer, if used. Refer to Installing Transformers and Reactors (Not Recommended) on page 1-17 for additional information.

Installing Power Wiring from the Input Filter Section to the Power Module

Use the following steps to connect AC input power to the drive:

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

1. Connect the three-phase AC input power leads (three-wire 380-480 VAC) to the appropriate terminals.
2. Tighten the AC input power terminals to the proper torque as shown in Table 1.D.

Table 1.D Terminal Tightening Torques

Terminals	Hardware Type	Maximum Tightening Torque (±10%)
L1 to L6	M10, Cl. 9.8	43 N-m (31 lb.-ft.)
U, V, W	M10, Cl. 9.8	43 N-m (31 lb.-ft.)
GND, PE	M8, Cl. 9.8	22 N-m (16 lb.-ft.)

Installing Output Power Wiring

This section provides instructions on wiring output contactors, motor overload protection, and output wiring to the motor.

Installing Mechanical Motor Overload Protection (Optional)

To provide the motor with overload protection, local, national, and international codes (e.g., NEC/CEC) may require one of the following:

- a motor thermostat be installed internal to the motor.
- a mechanical thermal motor overload relay, sized to protect the motor, be installed between the motor and the drive's output terminals.

In multiple motor applications (V/Hz regulation only), each motor must have its own user-supplied overload and branch circuit protection.

Installing Output Wiring from the Drive Output Terminals to the Motor

Important: The total motor lead length must not exceed 76 meters (250 feet).

Use the following steps to connect the AC output power wiring from the drive to the motor:

1. Wire the three-phase AC output power motor leads by routing them as shown in Figure 1.5.

   Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

ATTENTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe these precautions could result in damage to, or destruction of, the equipment

ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

2. Connect the three-phase AC power motor leads to the appropriate output terminals. Figure 1.5 shows the locations of the output power terminals.
3. Tighten the three-phase AC output power terminals to the proper torque as shown in Table 1.D.

Power Wiring

ATTENTION: National Codes and standards (NEC, VDE, BSI etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Cable Types Acceptable for 200-600 Volt Installations

A variety of cable types are acceptable for drive installations. For many installations, unshielded cable is adequate, provided it can be separated from sensitive circuits. As an approximate guide, allow a spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided. Do not use cable with an insulation thickness less than or equal to 15 mils (0.4mm/0.015 in.). Use Copper wire only. Wire gauge requirements and recommendations are based on 75°C. Do not reduce wire gauge when using higher temperature wire.

Unshielded

THHN, THWN or similar wire is acceptable for drive installation in dry environments provided adequate free air space and/or conduit fill rates limits are provided. **Do not use THHN or similarly coated wire in wet areas**. Any wire chosen must have a minimum insulation thickness of 15 mils and should not have large variations in insulation concentricity.

ATTENTION: To avoid a possible shock hazard caused by induced voltages, unused wires in the conduit must be grounded at both ends. For the same reason, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled. This will help minimize the possible shock hazard from “cross coupled” motor leads.

Shielded/Armored Cable

Shielded cable contains all of the general benefits of multi-conductor cable with the added benefit of a copper braided shield that can contain much of the noise generated by a typical AC Drive. Strong consideration for shielded cable should be given in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that may be affected by electrical noise in the distribution system. Applications with large numbers of drives in a similar location, imposed EMC regulations or a high degree of communications/networking are also good candidates for shielded cable.

Shielded cable may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance the motor can be located from the drive without the addition of motor protective devices such as terminator

networks. Refer to Reflected Wave in *Wiring and Grounding Guidelines for PWM AC Drives*, publication DRIVES-IN001.

Consideration should be given to all of the general specifications dictated by the environment of the installation, including temperature, flexibility, moisture characteristics and chemical resistance. In addition, a braided shield should be included and specified by the cable manufacturer as having coverage of at least 75%. An additional foil shield can be greatly improve noise containment.

A good example of recommended cable is Belden® 295xx (xx determines gauge). This cable has 4 XLPE insulated conductors with a 100% coverage foil and an 85% coverage copper braided shield (with drain wire) surrounded by a PVC jacket.

Table 1.E Recommended Shielded Wire

Location	Rating/Type	Description
Standard (Option 1)	600V, 90°C (194°F) XHHW2/RHW-2 Anixter B209500-B209507, Belden 29501-29507, or equivalent	• Four tinned copper conductors with XLPE insulation. • Copper braid/aluminum foil combination shield and tinned copper drain wire. • PVC jacket.
Standard (Option 2)	Tray rated 600V, 90°C (194°F) RHH/RHW-2 Anixter OLF-7xxxxx or equivalent	• Three tinned copper conductors with XLPE insulation. • 5 mil single helical copper tape (25% overlap min.) with three bare copper grounds in contact with shield. • PVC jacket.
Class I & II; Division I & II	Tray rated 600V, 90°C (194°F) RHH/RHW-2 Anixter 7V-7xxxx-3G or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor. • Black sunlight resistant PVC jacket overall. • Three copper grounds on #10 AWG and smaller.

Other types of shielded cable are available, but the selection of these types may limit the allowable cable length. Particularly, some of the newer cables twist 4 conductors of THHN wire and wrap them tightly with a foil shield. This construction can greatly increase the cable charging current required and reduce the overall drive performance. These cables are not recommended.

Using Input/Output Contactors

Input Contactor Precautions

ATTENTION: A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If an input device is used, operation must not exceed one cycle per minute or drive damage will occur.

ATTENTION: The drive start/stop/enable control circuitry includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove the AC line to the drive. An auxiliary braking method may be required.

Output Contactor Precaution

ATTENTION: To guard against drive damage when using output contactors, the following information must be read and understood. One or more output contactors may be installed between the drive and motor(s) for the purpose of disconnecting or isolating certain motors/loads. If a contactor is opened while the drive is operating, power will be removed from the respective motor, but the drive will continue to produce voltage at the output terminals. In addition, reconnecting a motor to an active drive (by closing the contactor) could produce excessive current that may cause the drive to fault. If any of these conditions are determined to be undesirable or unsafe, an auxiliary contact on the output contactor should be wired to a drive digital input that is programmed as “Enable.” This will cause the drive to execute a coast-to-stop (cease output) whenever an output contactor is opened.

I/O Wiring

Important points to remember about I/O wiring:

- Use Copper wire only. Wire gauge requirements and recommendations are based on 75°C. Do not reduce wire gauge when using higher temperature wire.
- Wire with an insulation rating of 600V or greater is recommended.
- Control and signal wires should be separated from power wires by at least 0.3 meters (1 foot).
- 4100CCF3 Flex I/O cable for use with DriveLogix™ is 0.9 meters (3 ft.) maximum length.

Important: I/O terminals labeled "(–)" or "Common" are not referenced to earth ground and are designed to greatly reduce common mode interference. Grounding these terminals can cause signal noise.

ATTENTION: Configuring an analog input for 0-20mA operation and driving it from a voltage source could cause component damage. Verify proper configuration prior to applying input signals.

ATTENTION: Hazard of personal injury or equipment damage exists when using bipolar input sources. Noise and drift in sensitive input circuits can cause unpredictable changes in motor speed and direction. Use speed command parameters to help reduce input source sensitivity.

Signal and Control Wire Types

Table 1.F Recommended Signal Wire

Signal Type/ Where Used	Wire Type(s)		Description	Minimum Insulation Rating
Standard Analog I/O	Belden 8760/9460 (or equiv.)		0.750 mm^2 (18 AWG), twisted pair, 100% shield with drain [5]	300V, 75-90°C (167-194°F)
Remote Pot	Belden 8770 (or equivalent)		0.750 mm^2 (18 AWG), 3 cond., shielded	
Encoder/Pulse I/O Less 30.5 m (100 ft.)	Combined:	Belden 9730 (or equivalent) [1]	0.196 mm^2 (24 AWG), individually shielded	
Encoder/Pulse I/O 30.5 m to 152.4 m (100 ft. - 500 ft.)	Signal:	Belden 9730/9728 (or equivalent) [1]	0.196 mm^2 (24 AWG), individually shielded	
	Power:	Belden 8790 [2]	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9892 [3]	0.330 mm^2 or 0.500 mm^2 [3]	
Encoder/Pulse I/O 152.4 m to 259.1 m (500 ft. - 850 ft.)	Signal:	Belden 9730/9728 (or equivalent) [1]	0.196 mm^2 (24 AWG), individually shielded	
	Power:	Belden 8790 [2]	0.750 mm^2 (18 AWG)	
	Combined:	Belden 9773/9774 (or equivalent) [4]	0.750 mm^2 (18 AWG), individually shielded pair	

[1] Belden 9730 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9728 (or equivalent).

[2] Belden 8790 is 1 shielded pair.

[3] Belden 9892 is 3 individually shielded pairs (3 channel), 0.33 mm^2 (22 AWG) plus 1 shielded pair 0.5 mm^2 (20 AWG) for power.

[4] Belden 9773 is 3 individually shielded pairs (2 channel plus power). If 3 channel is required, use Belden 9774 (or equivalent).

[5] If the wires are short and contained within a cabinet which has no sensitive circuits, the use of shielded wire may not be necessary, but is always recommended.

Table 1.G Recommended Control Wire for Digital I/O

Type	Wire Type(s)	Description	Insulation Rating
Unshielded	Per US NEC or applicable national or local code	—	300V, 60°C (140°F) minimum
Shielded	Multi-conductor shielded cable such as Belden 8770 (or equivalent)	0.750 mm^2 (18 AWG), 3 conductor, shielded.	

Wiring the Main Control Board I/O Terminals

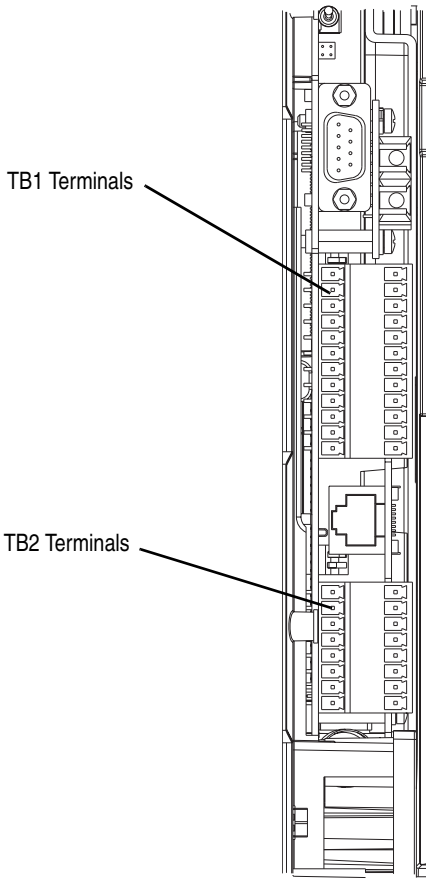
Terminal blocks TB1 and TB2 contain connection points for all inputs, outputs, and standard encoder connections. Both terminal blocks reside on the Main Control Board of the PF700S Control Cassette.

Remove the terminal block plug from the socket, and make connections.

Important: For NEMA 1 applications, all wiring must be routed through the conduit plate on the drive. Route any wires from the expanded cassette to the base cassette and out of the drive.

Reinstall the plug when wiring is complete. The terminal blocks have keys, which make it difficult to insert a terminal plug into the wrong socket.

Figure 1.9 Main Control Board I/O Terminal Locations



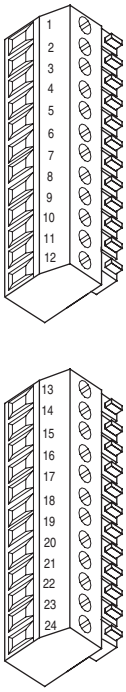
I/O Terminal Blocks

Table 1.H Main Control Board I/O Terminal Block Specifications

Name	Description	Wire Size Range[1]		Torque	
		Maximum	Minimum	Maximum	Recommended
I/O Blocks	Signal and encoder power connections	1.5 mm^2 (16 AWG)	0.14 mm^2 (28 AWG)	0.25 N-m (2.2 lb.-in.)	0.22 N-m (1.9 lb.-in.)

(1) Maximum/minimum that the terminal block will accept - these are not recommendations.

Table 1.I TB1 Terminals



Terminal	Signal	Description	Related Parameter
1	Analog Input 1 Common	Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign 20K ohm impedance at Volt; 500 ohm impedance at mA	
2	Analog Input 1 (+/-)		800
3	Shield	Analog Input Shield	
4	Analog Input 2 Common	Bipolar, differential input, +/-10V, 0-20 mA, 13 bit + sign 20K ohm impedance at Volt; 500 ohm impedance at mA	
5	Analog Input 2 (+/-)		806
6	Analog Input 3 [NTC-] Common	Differential input, 0-10V, 10 bit (for motor control mode FVC2, this is the temperature adaptation input).	
7	Analog Input 3 [NTC+]		812
8	Shield	Analog Output Shield	
9	Analog Output 1 (-)	Bipolar, differential input, +/-10V, 0-20 mA, 11 bit + sign 2K ohm minimum load	832, 833
10	Analog Output 1 (+)		
11	Analog Output 2 (-)		839, 840
12	Analog Output 2 (+)		
13	+10V Reference	Rating: 20 mA maximum load (recommend 5K ohm potentiometer)	
14	Reference Common		
15	-10V Reference		
16	Encoder A	Normal current draw per channel: 20 mA	230-233
17	Encoder A (Not)		
18	Encoder B		
19	Encoder B (Not)		
20	Encoder Z		
21	Encoder Z (Not)		
22	Encoder Reference (+)	12 or 5 V dc power supply for primary encoder interface Rating: 300 mA maximum	
23	Encoder Reference (-)		
24	Encoder Shield	Connection point for encoder shield	

Figure 1.10 TB1 Terminals — Analog Wiring Examples

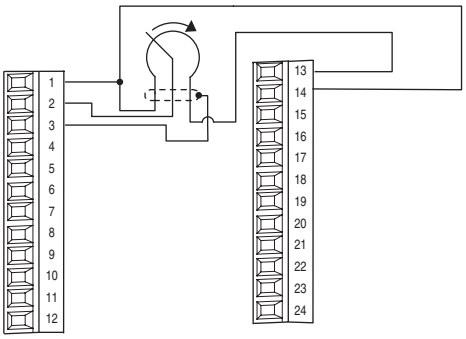
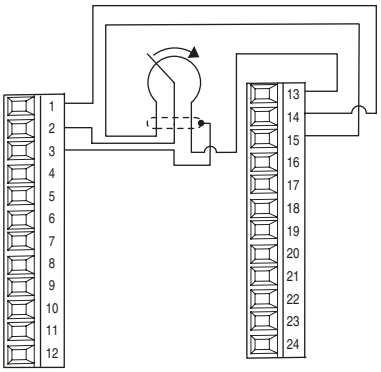
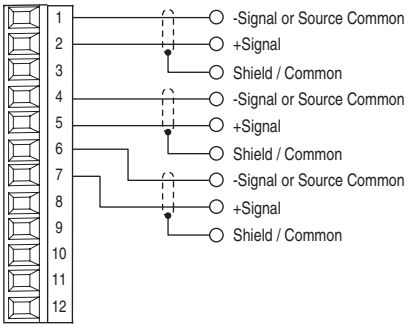
Input/Output	Connection Example	
0-10V Analog Input	0-10V Analog Input - Internal Source  	**Required Parameter Changes**
	0-10V Analog Input - Bipolar  	
	0-10V Analog Input - External Source  	

Figure 1.10 TB1 Terminals — Analog Wiring Examples (Continued)

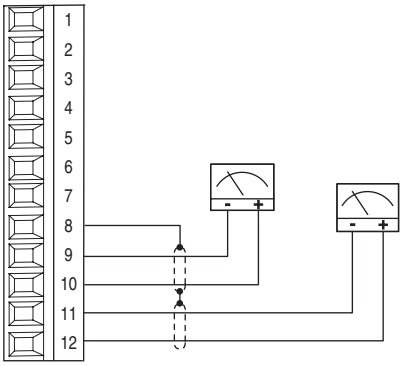
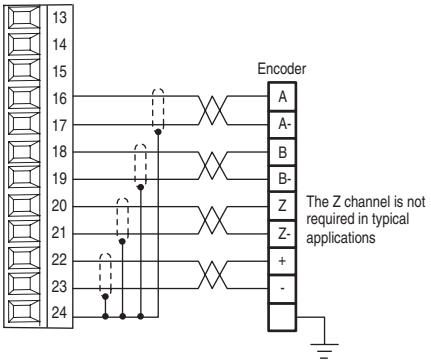
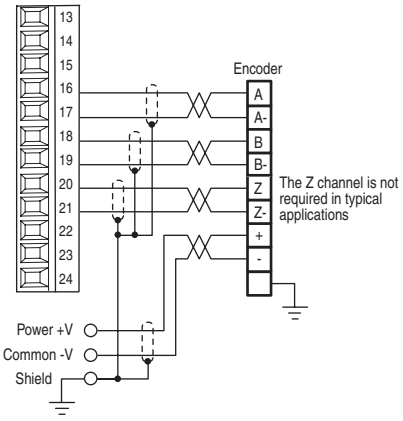
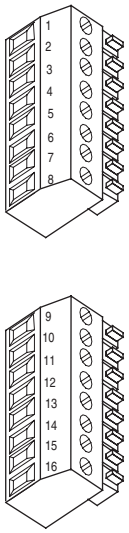
Input/Output	Connection Example	
Analog Output +/- 10V dc Used to drive analog meters displaying speed and current.	0-10V Analog Output 	**Required Parameter Changes** **Using Analog Output 1 (-10V to +10V) to meter Motor RPM and direction:** • Send the data to the Analog Output Parameter 833 [Anlg Out1 Real], the destination, linked to Parameter 71 [Filtered SpdFdbk], the source. • Scale the Output to the source parameter. Example: Parameter 835 [Anlg Out1 Scale] = 175 (where Parameter 4 [Motor NP RPM] 1750 is divided by 10V output). **Using Analog Output 2 (-10V to +10V) to meter Motor current:** • Send the data to the Analog Output Parameter 840 [Anlg Out2 Real], the destination, linked to Parameter 308 [Output Current], the source. • Scale the Output to the source parameter. Example: Parameter 822 [Anlg Out2 Scale] = xx (where Parameter 2 [Motor NP FLA] is divided by 10V output).
Primary Encoder Interface - Supports 5V dc/12 V dc differential encoders with internal power supply.	Primary Encoder - Internal Supply  Primary Encoder - External Supply 	**Using Encoder 0 as speed feedback:** • Set Parameter 222 [Motor Fdbk Sel Pri] to a value of 0 (Encoder 0 = default), so the drive will use this encoder as the primary motor speed feedback device. • Set the value of Parameter 232 [Encoder 0 PPR] to match the installed encoder's resolution (Pulses per Revolution).

Table 1.J TB2 Terminals



Terminal	Signal	Description	Related Parameter
1	24V dc Common (-)	Drive supplied 24V dc logic input power Rating: 300 mA maximum load	
2	24V dc Source (+)		
3	Digital Output 1	24V dc Open Collector (sinking logic) Rating: Internal Source = 150 mA maximum External Source = 750 mA	816, 847
4	Digital Output 1/2 Common	Common for Digital Outputs 1 and 2	
5	Digital Output 2	24V dc Open Collector (sinking logic) Rating: Internal Source = 150 mA maximum External Source = 750 mA	851, 852
6	Relay Output 3 (NC)	Relay contact output Rating: 115V ac or 24V dc = 2 A maximum Inductive/Resistive	856, 857
7	Relay Output 3 Common		
8	Relay Output 3 (NO)		
9	Digital Input 1-3 Common	Common for Digital Inputs 1, 2, and 3	
10	Digital Input 1	High speed 12-24V dc sourcing Digital Input Load: 15 mA at 24V dc	825
11	Digital Input 2		826
12	Digital Input 3	Load: 15 mA at 24V dc sourcing	827
13	Digital Input 4-6 Common	Common for Digital Inputs 4, 5, and 6	
14	Digital Input 4	Load: 10 mA at 24V dc sinking/sourcing Load: 7.5 mA at 115V ac	828
15	Digital Input 5		829
16	Digital Input 6 (HW Enable)		830

Figure 1.11 TB2 Terminals — Digital Wiring Examples

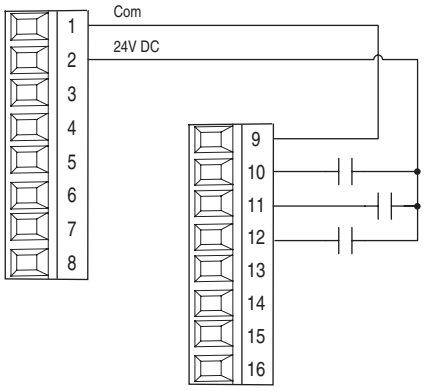
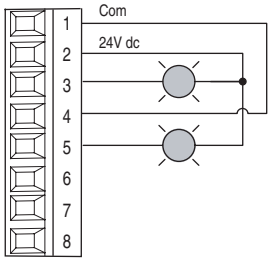
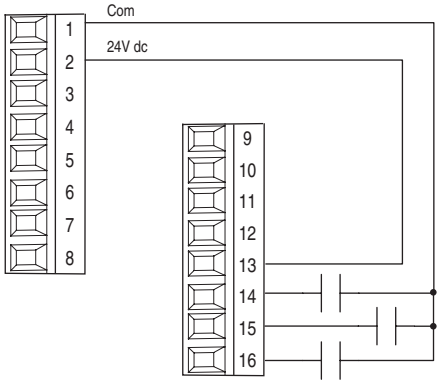
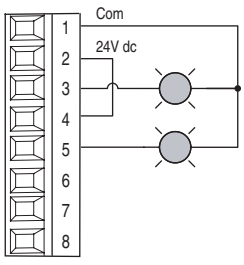
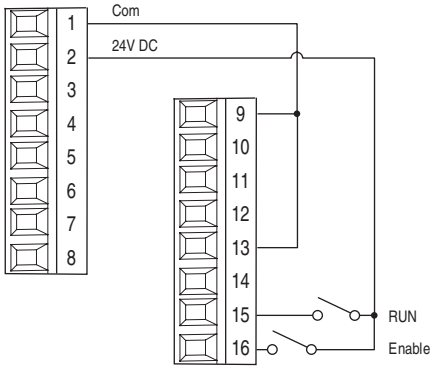
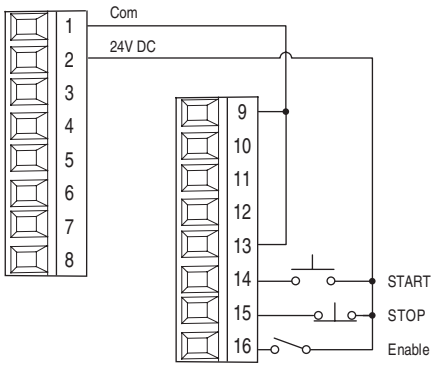
Input/Output	Connection Example	
Digital Inputs used for enable and precharge control. ***Note:*** **24V dc Supply** - supports only on-board digital inputs. Do not use for circuits outside the drive. ***Note:*** The factory default for all Digital Inputs is 24V. This must be switched in order to use 115V. ***Note:*** Digital Inputs 1, 2, and 3 are always 24V dc.	Sourcing Digital Inputs - using internal power supply  Sourcing Digital Outputs - using internal power supply  Sinking Digital Inputs - using internal power supply  Sinking Digital Outputs - using internal power supply 	**Sourcing and Sinking Definitions** The digital inputs and digital outputs of the LPM20 with High Performance Drive Control support Sourcing or Sinking configuration. Typically, digital inputs are sourcing devices and digital outputs are sinking devices. The following definitions apply throughout this section: **Sourcing a Digital Input** A. Connect the digital input common (return) directly to the power supply common. B. Applying positive voltage to the digital input will cause it to activate (pull up). **Sourcing a Digital Output** A. Connect the digital output common (return) directly to the power supply common. B. Connect the device to be controlled by the digital output to the positive voltage, and the device common to the digital output. **Sinking a Digital Input** A. Connect the digital input common to the power supply positive voltage. B. Applying 0V or common to the digital input will cause it to activate (pull down). **Sinking a Digital Output** A. Connect the digital output common (return) to the power supply positive voltage. B. Connect the digital output to the device to be controlled, and the device common to the power supply common. ***Note:*** Digital Inputs 1, 2, and 3 can only be configured as sourcing inputs. Digital Inputs 4, 5, and 6 can be configured as sourcing or sinking inputs.

Figure 1.11 TB2 Terminals — Digital Wiring Examples (Continued)

Input/Output	Connection Example	
Digital Inputs - 24V dc	Sourcing Digital Inputs - using internal power supply, 2-Wire Control 	**Required Parameter Changes** • Set Parameter 829 [DigIn 5 Sel] to a value of 7 (Run). • Parameter 153 [Control Options] bit 8 (3WireControl) will automatically be OFF for 2-wire control. • Set Parameter 168 [Normal Stop Mode] for the desired stopping mode: 0 = Ramp Stop 1 = CurLim Stop 2 = Coast Stop
	Sourcing Digital Inputs - using internal power supply, 3-Wire Control 	• Set Parameter 829 [DigIn 5 Sel] to a value of 14 (Normal Stop). • Set Parameter 828 [DigIn 4 Sel] to a value of 5 (Start). • Parameter 153 [Control Options] bit 8 (3WireControl) will automatically be ON for 3-wire control. • Set Parameter 168 [Normal Stop Mode] for the desired stopping mode: 0 = Ramp Stop 1 = CurLim Stop 2 = Coast Stop

Hard Enable Circuitry

A dedicated hardware enable input is provided on TB2 - Terminal 16 (Digital Input 6) for applications that require the drive to be disabled without software interpretation.

Main Control Board I/O and Encoder Settings

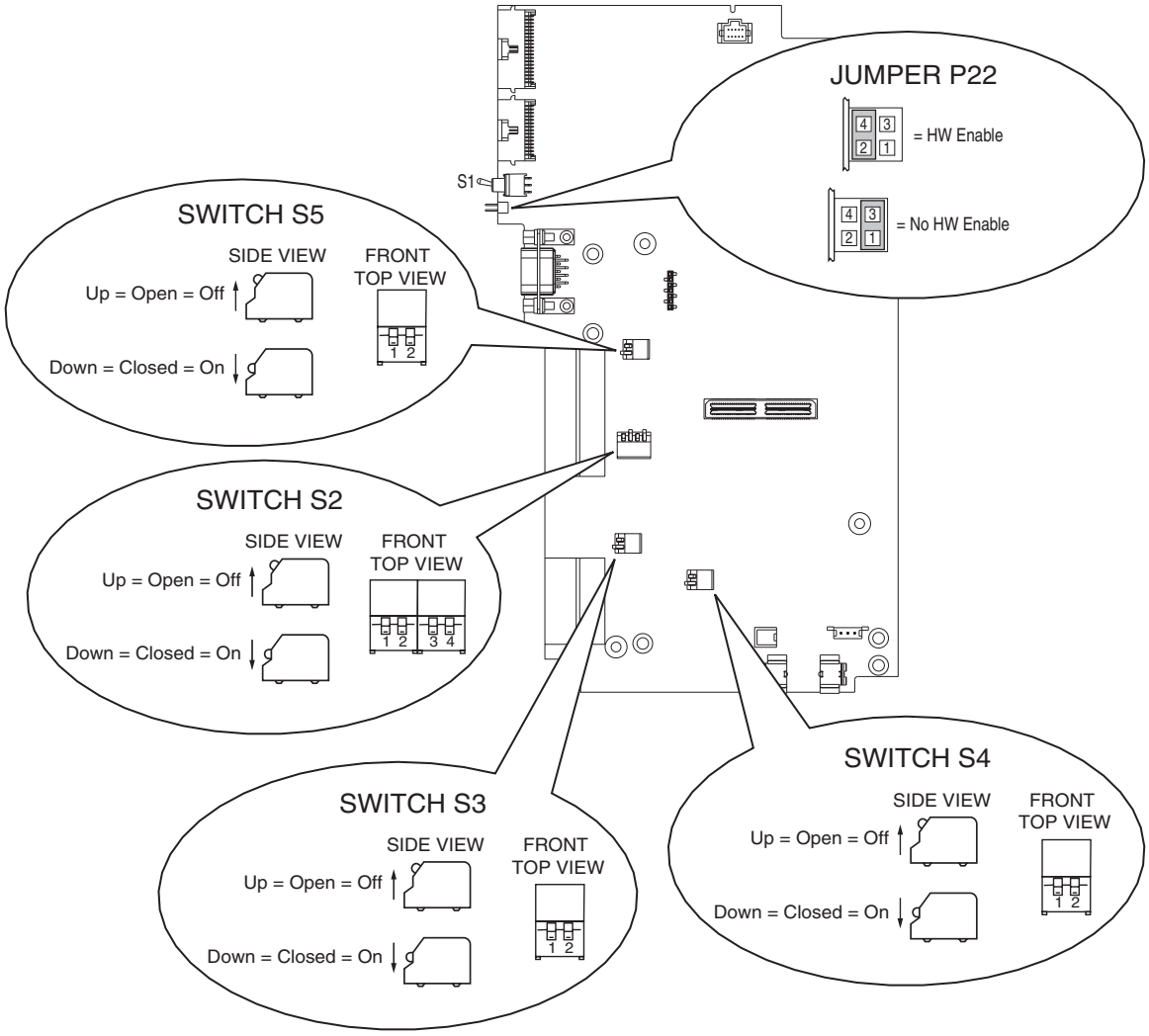


Table 1.K Switch Settings

Function	Switch	Open	Closed	Default	Notes
Configuring Digital Input 6 for Hardware Enable (HW Enbl)	P22 Jumper	pin 2-4 HW enable	pin 1-3 No enable	pin 2-4 HW enable	No jumper = HW enable
Analog Input 1	S5-1	Voltage	Current	Voltage	Change with Power Off.
Analog Input 2	S5-2	Voltage	Current	Voltage	Change with Power Off.
Digital Inputs 4-6 Voltage	S4-1, S4-2	115V ac	24V dc	24V dc	Change with Power Off.
Digital Input 1 Voltage	S3-1	24V dc	12V dc	24V dc	Change with Power Off.
Digital Input 2 Voltage	S3-2	24V dc	12V dc	24V dc	Change with Power Off.
Encoder Voltage Supply	S2-1	12V dc	5V dc	24V dc	Change with Power Off.
Encoder Signal A Voltage	S2-2	12V dc	5V dc	12V dc	Set all switches the same.
Encoder Signal B Voltage	S2-3	12V dc	5V dc	12V dc	
Encoder Signal Z Voltage	S2-4	12V dc	5V dc	12V dc	

Function	Switch	Open	Closed	Default	Notes
DriveLogix Processor	S1	RUN	Remote	Program	Processor mode.

Please note there are two separate values for an encoder.

Connecting SynchLink

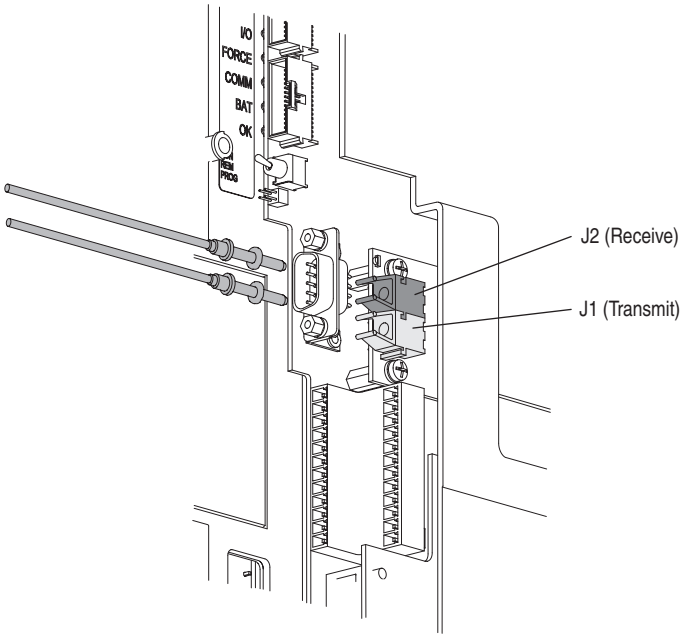
SynchLink provides high-speed synchronization and communication between multiple LPM20 drives with High Performance Drive Control (or other products with SynchLink capability).

Class 1 LED Product

ATTENTION: Hazard of permanent eye damage exists when using optical transmission equipment. This product emits intense light and invisible radiation. Do not look into module ports or fiber optic cable connectors.

When planning and connecting the SynchLink network, please refer to the *SynchLink System Design Guide (Publication No. 1756-TD008)*.

Connect cables to J1 (transmit) and J2 (receive) connectors on the left side of the Main Control Board. Push the plug into the socket until it produces an audible click.



Important: Do not overtighten tie-wraps.

Table 1.L SynchLink Cables and Accessories

Description	Cat. No.
2 x 1 M Fiber Optic Link	1403-CF001
2 x 3 M Fiber Optic Link	1403-CF003
2 x 5 M Fiber Optic Link	1403-CF005
10 M Fiber Optic Link	1403-CF010
20 M Fiber Optic Link	1403-CF020
50 M Fiber Optic Link	1403-CF050
100 M Fiber Optic Link	1403-CF100
250 M Fiber Optic Link	1403-CF250
500 M Fiber Optic Bulk	1403-CFBLK

Table 1.L SynchLink Cables and Accessories (Continued)

Description	Cat. No.
SynchLink Fiber-Hub, 1 input, Base	1751-SLBA
SynchLink Fiber-Hub, 4 output, “Star” Splitter	1751-SL4SP
SynchLink Bypass Switch	1751-SLBP/A

Table 1.M Fiber Optic Cable Assembly

Specification	
Connecting Cables	200/230 micron HCS (Hard Clad Silica) • Versalink V-System • Lucent Technologies, • Specialty Fibers Technology Division
Maximum Cable Length	300 meters with no more than one splice or one adapter
Minimum Cable Length	1 meter
Minimum inside bend radius	25.4mm (1 in.) Any bends with a shorter inside radius can permanently damage the fiber optic cable. Signal attention increases with decreased inside bend radius.
Operating Wavelength	650 nm (Red)
Data Rate	5 Mbps
Maximum Node Count	• 10 - Daisy Chain • 256 - Star Configuration

Active Converter Communication

The active converter communicates control and starts information with the 700S controller over DPI Data Link D.

- 700AC Parameter 71 - [Converter Status] is transferred to 700S Parameter 657 - [DPI Data In D1]. This may be used to monitor the operation of the active converter.
- 700S Parameter 666 - [DPI Data Out D1] is transferred to 700AC Parameter 70 - [Converter Control]. This may be used to start and stop the converter.
- 700S Parameter 667 - [DPI Data Out D2] is transferred to 700AC Parameter 72 - [Converter Min Vdc]. This may be used to set the minimum DC link voltage reference.

For more information, please refer to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…).

Auto Tune Operation

The pre-charge bypass contactor must be closed and the converter must be enabled before Auto Tuning of the inverter can be performed. See the section below on Pre-charge Operation to accomplish this.

700S Parameter 431 sets the current level for the Auto Tune procedure. The default value of 50.0% is high for large horsepower drives. A typical value for a motor connected to an LPM20 drive is 20.0%.

After the converter is ready and parameters are set correctly, the Auto Tune operation can be initiated from the HIM as described in the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual* (Publication No. 20D-UM006…).

Pre-charge Operation

The pre-charge bypass contactor is controlled by the active converter. On power up, the contactor is open so the pre-charge resistors limit the current charging the DC link. The contactor may operate in one of three ways as selected by 700AC-Parameter 50 - [Start Config]:

- If “Run On Start” is selected, then logic must be added to the application to turn on 700AC-Parameter 70 - [Converter Control] bit 0 to close the pre-charge and enable the converter to regulate the DC Link Voltage. The inverter may not be started until 700AC-Parameter 71 - [Converter Status] bits 2 and 3 have been turned on by the active converter.
- If “Run On PwrUp” is selected, then the pre-charge bypass contactor is automatically closed several seconds after power is turned on and the converter is automatically enabled.
- If “Manual Cntrl” is selected, then the pre-charge bypass contactor is manually controlled by 700AC-Parameter 52 - [Manual Control] bit 0, and enabling of the active converter is manually controlled by 700AC-Parameter 52 bit 1. This mode is primarily intended for troubleshooting or during startup.

WARNING: The user must verify that the pre-charge is closed before enabling the inverter or the pre-charge resistors may be damaged. This can be done with a Logix application program or by wiring the auxiliary contacts on the pre-charge bypass contactor in series with the run permissive on the inverter.

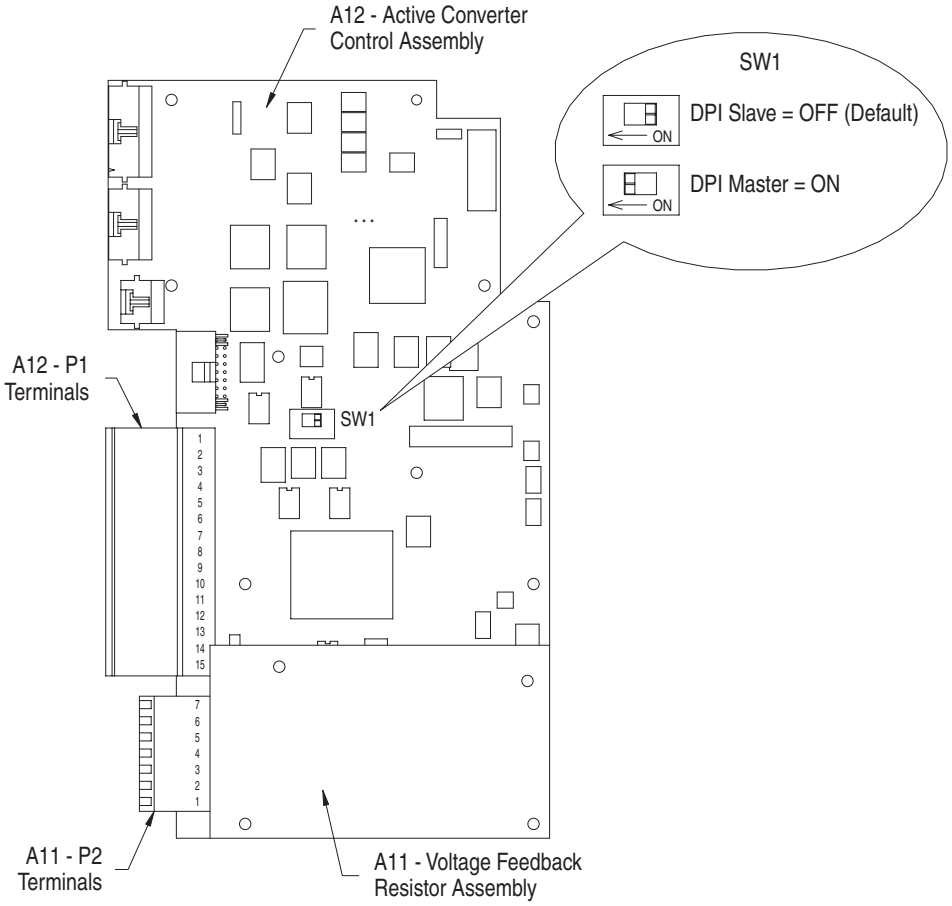
Wiring the Active Converter Control Board I/O Terminals

Terminal blocks A11-P2 and A12-P1 contain connection points for all inputs, outputs, and power connections to the Active Converter Control Board.

Remove the terminal block plug from the socket, and make connections. For more information, please refer to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. PFLEX-UM002…).

Reinstall the plug after wiring is complete. The terminal blocks have keys, which make it difficult to insert a terminal plug into the wrong socket.

Figure 1.12 Active Converter Control Board I/O Terminal Locations



I/O Terminal Blocks

Table 1.N Active Converter Control Board I/O Terminal Block Specifications

Name	Description	Wire Size Range[1]		Torque	
		Maximum	Minimum	Maximum	Recommended
I/O Blocks	Signal and power connections	1.5 mm^2 (16 AWG)	0.14 mm^2 (28 AWG)	0.25 N-m (2.2 lb.-in.)	0.22 N-m (1.9 lb.-in.)

(1) Maximum/minimum that the terminal block will accept - these are not recommendations.

Table 1.O Active Converter Control Board A12-P1 Terminal Descriptions

Pin	Description
1	Comm Out +
2	Comm Out -
3	SOC Out +
4	SOC Out -
5	Comm In +
6	Comm In -
7	SOC In +
8	SOC In -

Pin	Description
9	Aux Out N.O.
10	Aux Out Common
11	Analog In Signal
12	Analog In Common
13	Safety HW Enable
14	24 Vdc
15	Aux Input

Table 1.P Active Converter Voltage Feedback Board A11-P2 Terminal Descriptions

Pin	Description
1	L1
4	L2
7	L3

CE Conformity

EMC Instructions

CE Compliance

Compliance with the Low Voltage Directive 73/23/EEC and Electromagnetic Compatibility Directive 89/336/EEC has been demonstrated using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. LPM20 drives comply with the EN standards listed below when installed according to instructions in this section.

Low Voltage Directive (73/23/EEC)

- EN50178 Electronic equipment for use in power installations

EMC Directive (89/336/EEC)

- EN61800-3 Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

CE Declarations of Conformity are available online at:
http://www.ab.com/certification/ce/docs

General Notes

- Without additional external filtering, LPM20 drives satisfy the 2nd Environment high-frequency emission limits of EN61800-3. Without external mitigation, LPM20 drives are not intended to be used on a low-voltage public network which supplies residential or office premises; radio frequency interference is expected if used in such an environment.
- The drive motor cable should be kept as short as possible in order to minimize electromagnetic emission and capacitive currents.
- Use of line filters in ungrounded systems is not recommended.
- Conformity of the drive with CE EMC requirements does not guarantee an entire machine or installation complies with CE EMC requirements. Many factors influence overall machine/installation compliance.

Essential Requirements for CE Compliance

Conditions 1-5 listed below must be satisfied for LPM20 drives to meet the requirements of EN61800-3:

1. Standard LPM20 CE compliant drive.
2. Grounding as described in Grounding the Drive on page 1-13.
3. Output power wiring to the motor, and all control/signal wiring must use braided shielded cable with a shield coverage of 75% or greater, or metal conduit.
4. The shields of all shielded cables must be terminated with the proper connectors to chassis/earth.
5. Motor cables must not exceed 20 meters (65.6 feet) in length.

C-Tick Conformity

Compliance of LPM20 drives with the Australian Radiocommunications Act of 1992 has been demonstrated through compliance with EN61800-3. Both the General Notes and the Essential Requirements for CE Compliance provided above apply to C-Tick compliance for LPM20 drives.

C-Tick Declarations of Compliance are available online at: http://www.ab.com/certification/c-tick/index.html

Notes:

Start Up

This chapter describes how to start up the LPM20. Refer to Appendix B for a brief description of the LCD HIM (Human Interface Module).

For information on ...	See page ...
Prepare For Drive Start-Up	2-1
Status Indicators	2-3
Assisted Start Up	2-4

ATTENTION: Power must be applied to the drive to perform the following start-up procedure. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, **Do Not Proceed**. **Remove Power** including user-supplied control voltages. User-supplied voltages may exist even when main AC power is not applied to the drive. Correct the malfunction before continuing.

Prepare For Drive Start-Up

Before Applying Power to the Drive

Important: If you have a DriveLogix application, you must first connect the battery before starting this procedure.

❑ **1.** Confirm that motor wires are connected to the correct terminals and are secure.

❑ **2.** Confirm that encoder wires are connected to the correct terminals and are secure.

❑ **3.** Confirm that all inputs are connected to the correct terminals and are secure.

❑ **4.** Verify that AC line power at the disconnect device is within the rated value of the drive.

❑ **5.** Verify that control power voltage is correct.

The remainder of this procedure requires that a HIM be installed. If an operator interface is not available, remote devices should be used to start up the drive.

Applying Power to the Drive

❑ **6.** Apply AC power and control voltages to the drive.

If any digital input is configured to "Stop – CF" (CF = Clear Fault) or "Enable," verify that signals are present or the drive will not start. For a list of potential digital input conflicts or if a fault code appears, please refer to the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual (Publication No. 20D-UM006…), Chapter 4*.

❑ **7.** Examine the Inverter Status and Rectifier Status LEDs located on the DPI Communications Interface Board on the front of the power module (see Figure 2.1). Verify that they are flashing green. If not in this state, refer to the descriptions in Figure 3.1. Also, check the possible causes shown in Table 2.A and take necessary corrective action.

Table 2.A Common Causes of a Pre-Start Alarm

Examine Par 156 - [Run Inhibit Status]			
bit	**Description**		**Action**
1	No power is present at the Enable Terminal (TB2 -Terminal 16).		Apply the enable.
2, 3, 4	A stop command is being issued.		Close all stop inputs.
5	Power loss event is in progress, indicating a loss of the AC input voltage.		Restore AC power.
6	Data supplied by the power structure EEprom is invalid or corrupt.		Cycle power. If problem persists, replace the power structure.
7	Flash update in progress.		Complete Flash procedures.
8	Drive is expecting a Start Edge and is receiving a continuous signal.		Open all start buttons and remove all start commands.
9	Drive is expecting a Jog Edge and is receiving a continuous signal.		Open all jog buttons and remove all jog commands.
10	A conflict exists between the Encoder PPR programming (Par 232 or 242) and the encoder configuration for edge counts (Par 233 or 243, bits 4 and 5).		Verify encoder data and reprogram.
11	The drive cannot precharge because a precharge input is programmed and no signal is present.		Reprogram the input or close the precharge control contact.
12	Digital Configuration	Start input configured but stop not configured.	Program Par 838-840 to include a stop button; rewire the drive.
		Run input configured but control options do not match.	Program Par 153, Bit 8 to "0" (2 wire control).
		Start input configured but control options do not match.	Program Par 153, Bit 8 to "1" (3 wire control).
		Multiple inputs configured as Start or Run.	Reprogram Par 838-840 so multiple starts, multiple runs or any combination do not exist.
		Multiple inputs configured as Jog1.	Program Par 838-840 so only (1) is set to Jog1.
		Multiple inputs configured as Jog 2.	Program Par 838-840 so only (1) is set to Jog2.
		Multiple inputs configured as Fwd/Rev.	Program Par 838-840 so only (1) is set to Fwd/Rev.
14	Invalid Feedback Device for Permanent Magnet Motor Control		Set Par 222 to a value of "5" (FB Opt Port0)

❑ **8.** Proceed to Start-Up routine.

Status Indicators

Figure 2.1 Drive Inverter and Rectifier Status LEDs

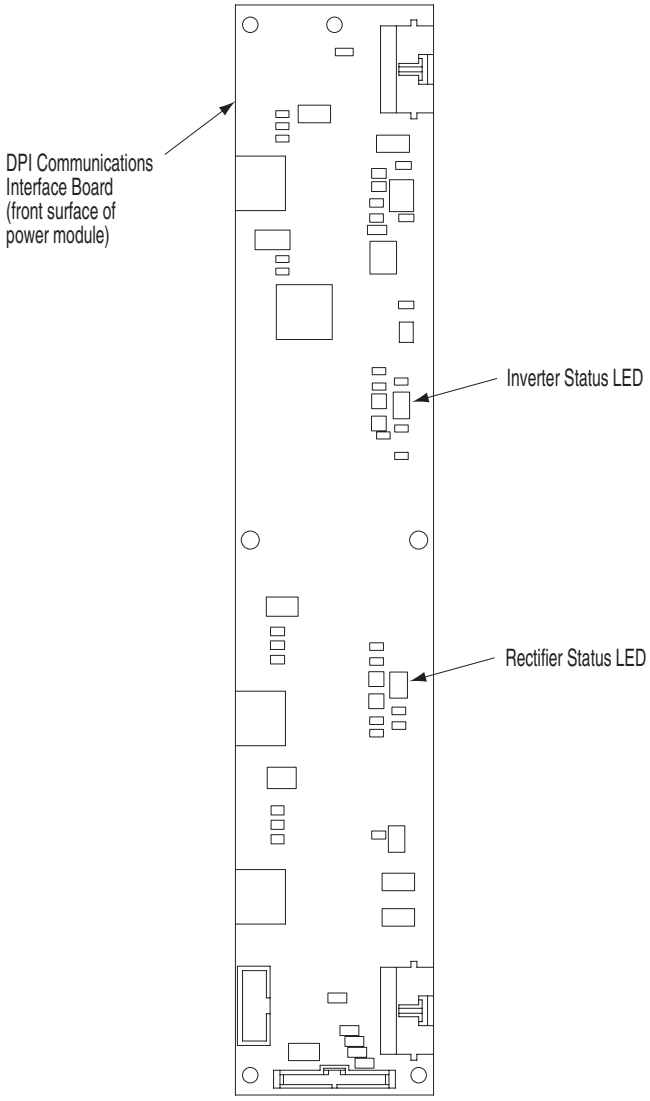
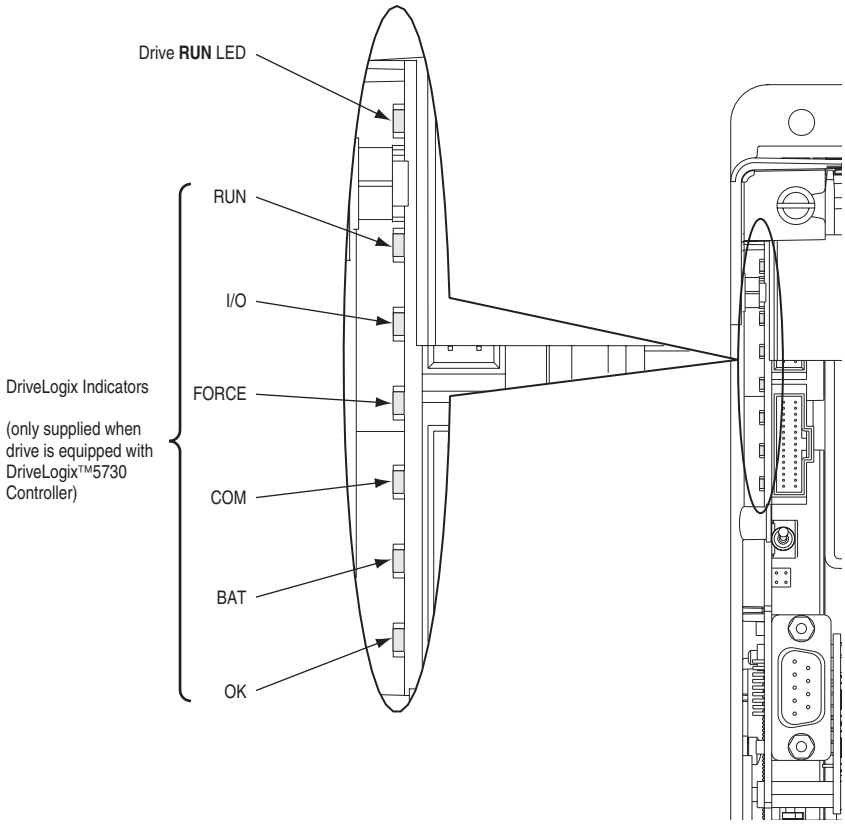


Figure 2.2 Drive RUN LED on PF700S Control Cassette



Name	Color	State	Description
Drive **RUN** LED (topmost indicator)	Green	Off	Drive inverter is not providing a modulated output.
		Steady	Drive inverter is providing a modulated output.
DriveLogix Indicators	For status descriptions of the six DriveLogix indicators, please refer to the *DriveLogix™5730 Controller User Manual (Publication No. 20D-UM003..).*		

If the DriveLogix option is not present, the associated indicators will not be present.

Important Information

Power must be applied to the drive when viewing or changing parameters. Previous programming may affect the drive status and operation when power is applied.

Assisted Start Up

For Assisted Start-Up information, please refer to the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual (Publication No. 20D-UM006..) in Chapter 2*.

Troubleshooting

Chapter 3 provides information to guide you in troubleshooting the LPM20 with High Performance Drive Control.

For information on ...	See page ...
Faults and Alarms	3-1
Drive Status	3-2
Manually Clearing Drive Faults	3-3
Drive Fault Descriptions	3-3
Active Converter Fault Descriptions	3-3
Clearing Drive Alarms	3-3
Common Symptoms and Corrective Actions	3-4
Test Equipment Needed To Troubleshoot	3-6
Verifying That DC Bus Capacitors Are Discharged	3-6
Replacement Parts	3-7

Faults and Alarms

A fault is a condition that stops the drive. There are two fault types.

Type	Fault Description	
①	Non-Resettable	This type of fault normally requires drive or motor repair. The cause of the fault must be corrected before the fault can be cleared. The fault will be reset on power up after repair.
②	User Configurable	These faults can be enabled/disabled to annunciate or ignore a fault condition.

An alarm is a condition that, if left untreated, may stop the drive. There are two alarm types.

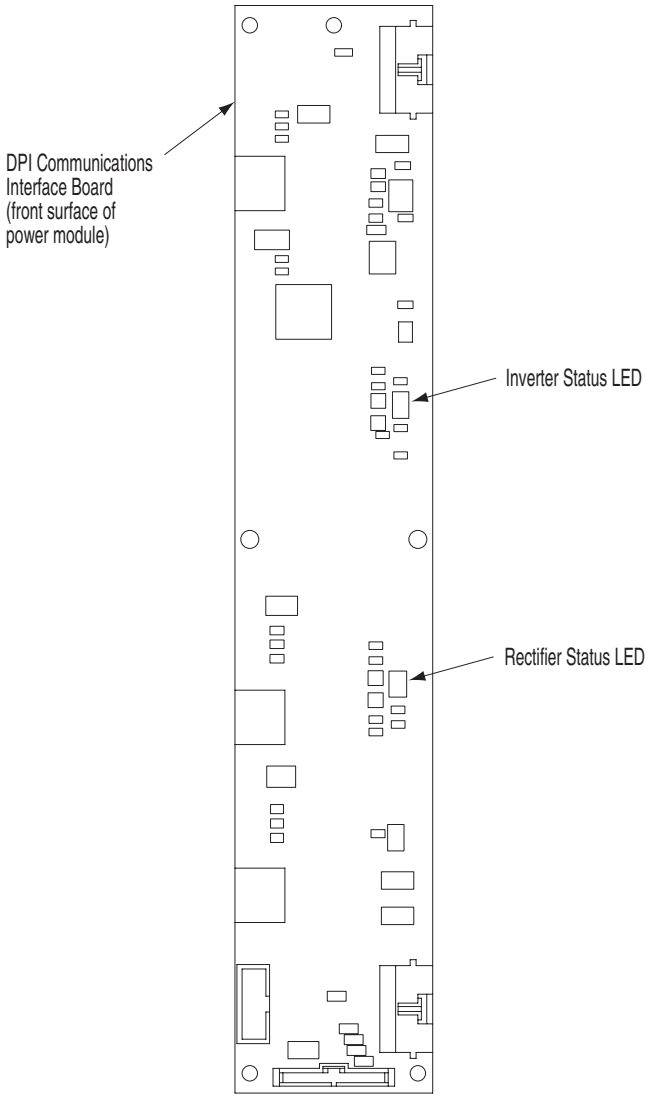
Type	Alarm Description	
①	User Configurable	These alarms can be enabled or disabled through [Alarm Config 1] parameter.
②	Non-Configurable	These alarms are always enabled.

Drive Status

Power Module LED Indications

The Inverter Status LED and Rectifier Status LED are located on the DPI Communications Interface Board on the front of the power module. The LEDs indicate the status of the inverter and the rectifier as shown in the table in Figure 3.1. Note that if the LEDs are off, it indicates the drive is not receiving power.

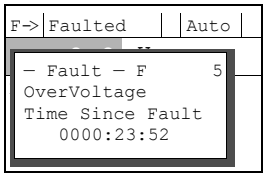
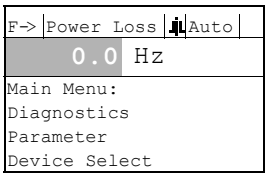
Figure 3.1 Inverter and Rectifier Status LEDs and Indications



Color	State	Description
Green	Flashing	Drive ready, but not running and no faults are present.
	Steady	Drive running, no faults are present.
Yellow	Flashing	A type 2 (non-configurable) alarm condition exists, but drive continues to run.
	Steady	A type 1 (user configurable) alarm condition exists, but drive continues to run.
Red	Flashing	A fault has occurred.
	Steady	A non-resettable fault has occurred.

HIM Indication

The LCD HIM also provides visual notification of a fault or alarm condition.

Condition	Display
Drive is indicating a fault. The LCD HIM immediately reports the fault condition by displaying the following: • "Faulted" appears in the status line • Fault number • Fault name • Time that has passed since fault occurred Press Esc to regain HIM control.	
Drive is indicating an alarm. The LCD HIM immediately reports the alarm condition by displaying the following: • Alarm name (Type 2 alarms only) • Alarm bell graphic	

Manually Clearing Drive Faults

Step	Key(s)
1. Press Esc to acknowledge the fault. The fault information will be removed so that you can use the HIM.	Esc
2. Address the condition that caused the fault. The cause must be corrected before the fault can be cleared.	
3. After corrective action has been taken, clear the fault by **one** of these methods: • Press Stop • Cycle drive power • Set parameter 240 [Fault Clear] to "1." • "Clear Faults" on the HIM Diagnostic menu.	

Drive Fault Descriptions

For a complete list and description of drive faults (with possible corrective actions, when applicable) and alarms, please refer to the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual* (Publication No. 20D-UM006…) *in Chapter 4*.

Active Converter Fault Descriptions

For a complete list and description of active converter faults (with possible corrective actions, when applicable) and alarms, please refer to the *PowerFlex 700 Active Converter Power Module User Manual* (Publication No. 20D-UM006…) *in Chapter 4*.

Clearing Drive Alarms

Drive alarms are automatically cleared when the condition that caused the alarm is no longer present.

Common Symptoms and Corrective Actions

Drive does not Start from Start or Run Inputs wired to the terminal block.

Cause(s)	Indication	Corrective Action
Drive is faulted.	Flashing red status light.	Clear the fault: • Press HIM Stop key if HIM is control source. • Cycle power. • Set [Fault Clear] parameter to 1. • "Clear Faults" on the HIM Diagnostic menu.
Incorrect input wiring. See Figure 1.11 for wiring examples.	None	Wire inputs correctly and/or install jumper.
Incorrect digital input programming. • Mutually exclusive choices have been made (i.e., Jog and Jog Forward). • Exclusive functions (i.e, direction control) may have multiple inputs configured. • Stop is factory default and is not wired or is open.	None	Program [Digital Inx Sel] parameter for correct inputs. Start or Run programming may be missing.
	Flashing yellow status light and "DigIn CflctB" indication on LCD HIM. [Drive Status 2] shows type 2 alarm(s).	Program [Digital Inx Sel] parameter to resolve conflicts. Remove multiple selections for the same function. Install stop button to apply a signal at stop terminal.

Drive does not Start from HIM.

Cause(s)	Indication	Corrective Action
Drive is programmed for 2 wire control. HIM Start button is disabled for 2 wire control.	None	If 2 wire control is required, no action needed. If 3 wire control is required, program [Digital Inx Sel] parameter for correct inputs.
Active fault.	Flashing or steady red LED.	Reset fault.
Enable input is open.	Flashing yellow LED.	Close terminal block enable input.

Drive does not respond to changes in Speed Command.

Cause(s)	Indication	Corrective Action
No value is coming from the source of the command.	LCD HIM Status Line indicates "At Speed" and output is 0 Hz.	1. If the source is an analog input, check wiring and use a meter to check for presence of signal. 2. Check [Commanded Freq] parameter for correct source.
Incorrect reference source has been programmed.	None	3. Check [Speed Ref Source] parameter for the source of the speed reference. 4. Reprogram [Speed Ref A Sel] parameter for correct source.
Incorrect reference source is being selected via remote device or digital inputs.	None	5. Check [Drive Status 1] parameter, bits 12 and 13 for unexpected source selections. 6. Check [Dig In Status] parameter to see if inputs are selecting an alternate source. 7. Reprogram digital inputs to correct "Speed Sel x" option.

Motor and/or drive will not accelerate to Commanded Speed.

Cause(s)	Indication	Corrective Action
Acceleration time is excessive.	None	Reprogram [Accel Time x] parameter.
Excess load or short acceleration times force the drive into current limit, slowing or stopping acceleration.	None	1. Check [Drive Status 2] parameter, bit 10 to see if the drive is in Current Limit. 2. Remove excess load or reprogram [Accel Time x] parameter.
Speed command source or value is not as expected.	None	Check for the proper Speed Command using Steps 1 through 7 previously described.
Programming is preventing the drive output from exceeding limiting values.	None	Check [Maximum Speed] parameter and [Maximum Freq] parameter to assure that speed is not limited by programming.

Motor operation is unstable.

Cause(s)	Indication	Corrective Action
Motor data was incorrectly entered.	None	Correctly enter motor nameplate data.

Drive will not reverse motor direction.

Cause(s)	Indication	Corrective Action
Digital input is not selected for reversing control.	None	Check [Digital Inx Sel] parameter. Choose correct input and program for reversing mode.
Digital input is incorrectly wired.	None	Check input wiring. (See page 1-25)
Direction mode parameter is incorrectly programmed.	None	Reprogram [Direction Mode] parameter for analog “Bipolar” or digital “Unipolar” control.
Motor wiring is improperly phased for reverse.	None	Switch two motor leads.
A bipolar analog speed command input is incorrectly wired or signal is absent.	None	1. Use meter to check that an analog input voltage is present. 2. Check wiring. (See page 1-25) Positive voltage commands forward direction. Negative voltage commands reverse direction.

Test Equipment Needed To Troubleshoot

An isolated multimeter will be needed to measure the DC bus voltage and to make resistance checks. Note that dedicated troubleshooting test points are not provided.

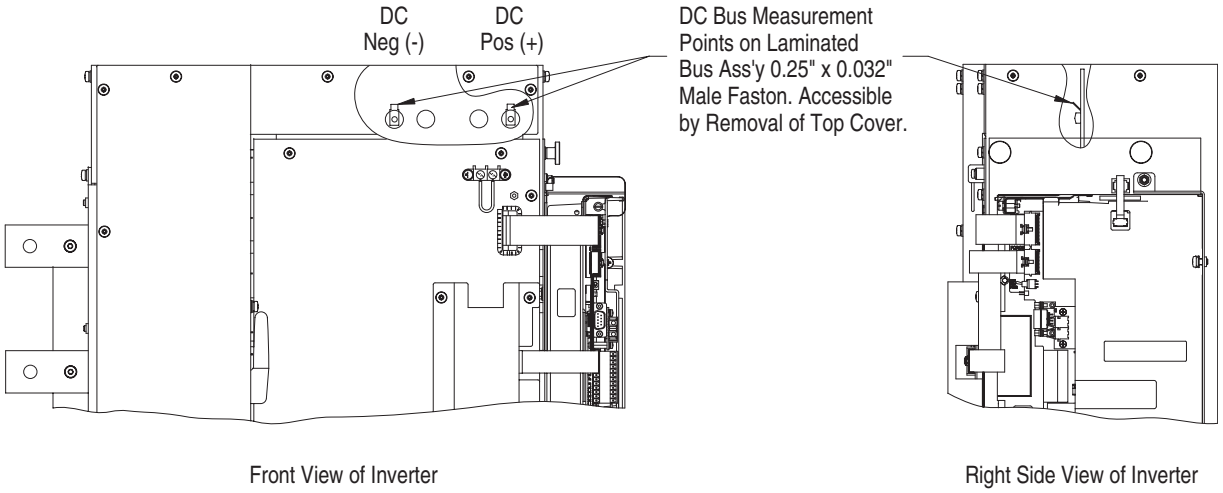
Verifying That DC Bus Capacitors Are Discharged

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

The LPM20 drive's DC bus capacitors retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components:

1. Turn off and lock out input power. Wait five minutes.
2. Verify that there is no voltage at the power module's input power terminals (L1, L2, and L3) as shown in Figure 1.8.
3. Measure the DC bus potential with a voltmeter while standing on a non-conductive surface and wearing insulated gloves (1000 V). The DC bus measurement points are located on the Inverter (see Figure 3.2).
4. After the drive has been serviced, reapply input power.

Figure 3.2 Location of DC Bus Voltage Measurement Points



Replacement Parts

Table 3.A lists the replacement parts that are available from Allen-Bradley. For parts locations, refer to Figure 1.1, Figure 1.2, and Figure 1.3.

Table 3.A Drive Replacement Parts

Voltage Class	Drive Current Rating	Description	Catalog Number	Qty. per Drive
400/480	608A	80W Power Supply Assembly	SP-180944-A01	2
400/480	608A	Inlet Hose & Outlet Hose Assys, w/spare O-ring	SP-349811-A01	1
400/480	608A	Resistor, Filter, 100K ohm, 50W, Kit - (3) per box	SP-352489-A01	1
400/480	608A	Resistor, Precharge, 10 ohm, 300W, Kit - (3) per box)	SP- 322542-A01	1
400/480	608A	Control Transformer, Multi-tap, 3 KVA	SP-180086	1
400/480	608A	Wire Harness Assy, P1 Connector-to-Input Filter Control	SP-181251-A01	1
400/480	608A	Cap Bank Assy, Input Filter, 608A	SP-342008-A01	1
400/480	608A	Inductor, Input Filter, 608A	SP-180824-C01	1
400/480	608A	Inverter Power Interface Assy, 608A	SP-180940-A04	1
400/480	608A	Contactor, AC Precharge, 140A, 600 VAC	100-D140D11	3

Replacement Fuses

For replacement fuses, refer to the drive wiring diagram on page C-2.

Notes:

Supplemental Drive Information

For information on ...	See page ...
Specifications	A-1
Communication Configurations	A-3

Specifications

Category	Specification	
Agency Certification	c UL us	Listed to UL508C and CAN/CSA-C2.2 No. 14-M91.
	CE	Marked for all applicable European Directives[1]: EMC Directive (89/336/EEC) EN 61800-3 Adjustable Speed electrical power drive systems Low Voltage Directive (73/23/EEC) EN 50178 Electronic Equipment for use in Power Installations
	The drive is also designed to meet the following specifications: NFPA 70 - US National Electrical Code NEMA ICS 3.1 - Safety standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems. IEC 146 - International Electrical Code.	

(1) Applied noise impulses may be counted in addition to the standard pulse train causing erroneously high [Pulse Freq] readings.

Category	Specification	
Protection	**Drive**	480V
	AC Input Overvoltage Trip:	570Vac
	AC Input Undervoltage Trip:	280Vac
	Bus Overvoltage Trip:	810Vdc
	Bus Undervoltage Shutoff/Fault:	305Vdc
	Nominal Bus Voltage:	648Vdc
	All Drives	
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip
	Drive Overcurrent Trip Software Overcurrent Trip: Hardware Overcurrent Trip:	 200% of rated current (typical) 220-300% of rated current (dependent on drive rating)
	Line transients:	Up to 6000 volts peak per IEEE C62.41-1991
	Control Logic Noise Immunity:	Showering arc transients up to 1500V peak
	Power Ride-Thru:	15 milliseconds at full load
	Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical
	Ground Fault Trip:	Phase-to-ground on drive output
	Short Circuit Trip:	Phase-to-phase on drive output
Environment	Altitude:	1000 m (3300 ft) max. without derating
	Maximum Surrounding Air Temperature without Derating: IP20, NEMA Type 1:	 0 to 40°C (32 to 104°F)
	Storage Temperature (all constructions):	–40 to 70°C (–40 to 158°F)

Category	Specification	
Environment (continued)	Atmosphere:	**Important:** Drive **must not** be installed in an area where the ambient atmosphere contains volatile or corrosive gas, vapors or dust. If the drive is not going to be installed for a period of time, it must be stored in an area where it will not be exposed to a corrosive atmosphere.
	Relative Humidity:	5 to 95% non-condensing
	Shock:	15G peak for 11 milliseconds duration (±1.0 ms)
	Vibration:	0.152 mm (0.006 in.) displacement, 1G peak
Electrical	Voltage Tolerance:	For full power and operating range, see the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual* (Publication No. 20D-UM006…), Appendix E.
	Frequency Tolerance:	47-63 Hz.
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation provides 50% of rated current.
	Displacement Power Factor:	0.98 across entire speed range.
	Efficiency:	97.5% at rated amps, nominal line volts.
	Max. Short Circuit Rating:	100,000 Amps symmetrical.
	Actual Short Circuit Rating:	Determined by AIC rating of installed circuit breaker.
	Motor Lead Lengths:	76 meters (250 feet) total
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the *Derating Guidelines* in the *PowerFlex Reference Manual*). The drive can be supplied as 6 pulse or 12 pulse in a configured package.
	Carrier Frequency:	2, 3 or 4 kHz. Drive rating based on 4 kHz.
	Output Voltage Range:	0 to rated motor voltage
	Output Frequency Range:	0 to 400 Hz.
	Speed Control:	Speed Regulation - without feedback 0.1% of base speed across 120:1 speed range 120:1 operating range 50 rad/sec bandwidth
		Speed Regulation - with feedback 0.001% of base speed across 120:1 speed range 1000:1 operating range 300 rad/sec bandwidth
	Torque Regulation:	Torque regulation - without Feedback ± 10%, 600 rad/sec bandwidth
		Torque regulation - with Feedback ± 5%, 4400 rad/sec bandwidth
	Selectable Motor Control:	Field Oriented Control with and without a feedback device and permanent magnet motor control.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, and Current Limit.
	Accel/Decel:	Independently programmable accel and decel times, adjustable from 0 - 6553.5 seconds in 0.01 second increments.
	S-Curve Time	Adjustable from 0.5 to 4.0 seconds
	Intermittent Overload:	110% Overload capability for up to 1 minute 150% Overload capability for up to 3 seconds
	Current Limit Capability:	Proactive Current Limit programmable from 20 to 160% of rated output current. Independently programmable proportional and integral gain.
	Electronic Motor Overload Protection:	Class 10 protection with speed sensitive response. Investigated by U.L. to comply with N.E.C. Article 430. U.L. File E59272, volume 12.

Category	Specification	
Feedback	Encoder Inputs (2):	Dual Channel Plus Marker, Isolated with differential transmitter output (Line Drive), Incremental, Dual Channel Quadrature type
	Encoder Voltage Supply:	5V dc or 12V dc (5V dc requires an external power supply), 320 mA/channel
	Maximum Input Frequency:	400 kHz
	Stegmann Hi-Resolution Option:	
	Encoder Voltage Supply:	11.5V dc @ 130 mA
	Hi-Resolution Feedback:	Sine/Cosine 1V P-P Offset 2.5
	Maximum Cable Length:	182 m (600 ft.)
	RS-485 Interface:	Hi-Resolution Feedback Option card obtains the following information via the Hiperface RS-485 interface shortly after power-up: Address, Command Number, Mode, Number of Turns, Number of Sine/Cos cycles, Checksum
	Customer-I/O Plug (P1) - Hi Res:	Allen-Bradley PN: S94262912
		Weidmuller PN: BL3.50/90/12BK
	Resolver Option:	
	Excitation Frequency:	2400 Hz
	Excitation Voltage:	4.25 - 26 Vrms
	Operating Frequency Range:	1 - 10 kHz
	Resolver Feedback Voltage:	2V ±300mV
	Maximum Cable Length:	304.8 m (1000 ft.)
DriveLogix	User Available Memory Base:	1.5 megabytes
	Battery:	1756-BA1 (Allen-Bradley PN 94194801) 0.59g lithium
	Serial Cable:	1761-CBLPM02 to 1761-NET-AIC
		1761-CBLPA00 to 1761-NET-AIC
		1756-CP3 directly to controller
		1747-CP3 directly to controller
		Category 3 (2)
	Compact I/O Connection:	Up to (30) modules
	Cable:	20D-DL2-CL3 20D-DL2-CR3

Communication Configurations

Typical Programmable Controller Configurations

Important: If programs are written that continuously write information to the drive, care must be taken to properly format the block transfer. If attribute 10 is selected for the block transfer, values will be written only to RAM and will not be saved by the drive. This is the preferred attribute for continuous transfers. If attribute 9 is selected, each program scan will complete a write to the drive's non-volatile memory (EEprom). Since the EEprom has a fixed number of allowed writes, continuous block transfers will quickly damage the EEprom. Do Not assign attribute 9 to continuous block transfers. Refer to the individual communications adapter User Manual for additional details.

Logic Command Word

Logic Bits																	
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Command	Description
															x	Normal Stop	0 = Not Normal Stop 1 = Normal Stop
														x		Start[1]	0 = Not Start 1 = Start
													x			Jog 1	0 = Not Jog using [Jog Speed 1] 1 = Jog using [Jog Speed 1]
												x				Clear Fault[2]	0 = Not Clear Fault 1 = Clear Fault
										x	x					Unipolar Direction	00 = No Command 01 = Forward Command 10 = Reverse Command 11 = Hold Direction Control
									x							Reserved	
								x								Jog 2	0 = Not Jog using [Jog Speed 2] 1 = Jog using [Jog Speed 2]
							x									Current Limit Stop	0 = Not Current Limit Stop 1 = Current Limit Stop
						x										Coast Stop	0 = Not Coast to Stop 1 = Coast to Stop
					x											Spd Ramp Hold	000 = Spd Ref A 001 = Spd Ref B 010 = Preset 2 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
				x												Reserved	
			x													Spd Ref Sel0	000 = Spd Ref A 001 = Spd Ref B 010 = Preset 2 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
		x														Spd Ref Sel1	000 = Spd Ref A 001 = Spd Ref B 010 = Preset 2 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
	x															Spd Ref Sel2	000 = Spd Ref A 001 = Spd Ref B 010 = Preset 2 011 = Ref. 3 (Preset 3) 100 = Ref. 4 (Preset 4) 101 = Ref. 5 (Preset 5) 110 = Ref. 6 (Preset 6) 111 = Ref. 7 (Preset 7)
x																Reserved	

(1) A Not Stop condition (logic bit 0 = 0, logic bit 8 = 0, and logic bit 9 = 0) must first be present before a 1 = Start condition will start the drive.

(2) To perform this command, the value must switch from “0” to “1.”

Logic Status Word

Logic Bits																	
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**Status**	**Description**
															x	Enabled	0 = Not Enabled 1 = Enabled
														x		Running	0 = Not Running 1 = Running
													x			Command Direction	0 = Reverse 1 = Forward
												x				Actual Direction	0 = Reverse 1 = Forward
											x					Accel	0 = Not Accelerating 1 = Accelerating
										x						Decel	0 = Not Decelerating 1 = Decelerating
									x							Jogging	0 = Not Jogging 1 = Jogging
								x								Fault	0 = No Fault 1 = Fault
							x									Alarm	0 = No Alarm 1 = Alarm
						x										Flash Mode	0 = Not in Flash Mode 1 = In Flash Mode
					x											Run Ready	0 = Not Ready to Run 1 = Ready to Run
				x												At Limit (1)	0 = Not At Limit 1 = At Limit
			x													Tach Loss Sw	0 = Not Tach Loss Sw 1 = Tach Loss Sw
		x														At Zero Spd	0 = Not At Zero Speed 1 = At Zero Speed
	x															At Setpt Spd	0 = Not At Setpoint Speed 1= At Setpoint Speed
x																Reserved	

(1) See Par 304 - [Limit Status] in the *PowerFlex 700S High Performance AC Drive — Phase II Control User Manual (Publication No. 20D-UM006…)* for a description of the limit status conditions.

Notes:

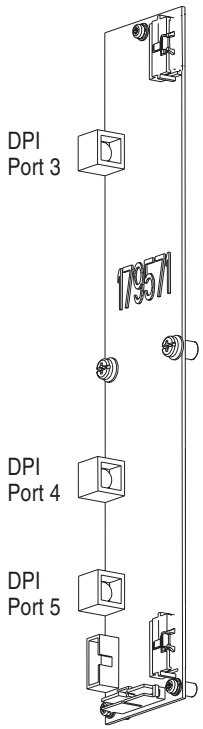
HIM Overview

For information on …	See page
Remote HIM Connection	B-1
LCD Display Elements	B-2
ALT Functions	B-2
Menu Structure	B-3
Viewing and Editing Parameters	B-5
Removing/Installing the HIM	B-6

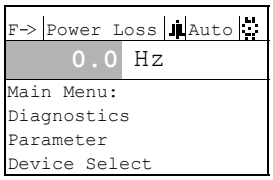
Remote HIM Connection

The LPM20 provides a cable connection point (DPI Port 4) for a remote LCD HIM. This port is located on the Communications Interface Assembly (item 29 shown in Figure 1.3).

Figure B.1 DPI Port 4 Location for Remote HIM Connection



LCD Display Elements

Display	Description
	Direction | Drive Status | Alarm | Auto/Man | Information Commanded or Output Frequency Programming / Monitoring / Troubleshooting

ALT Functions

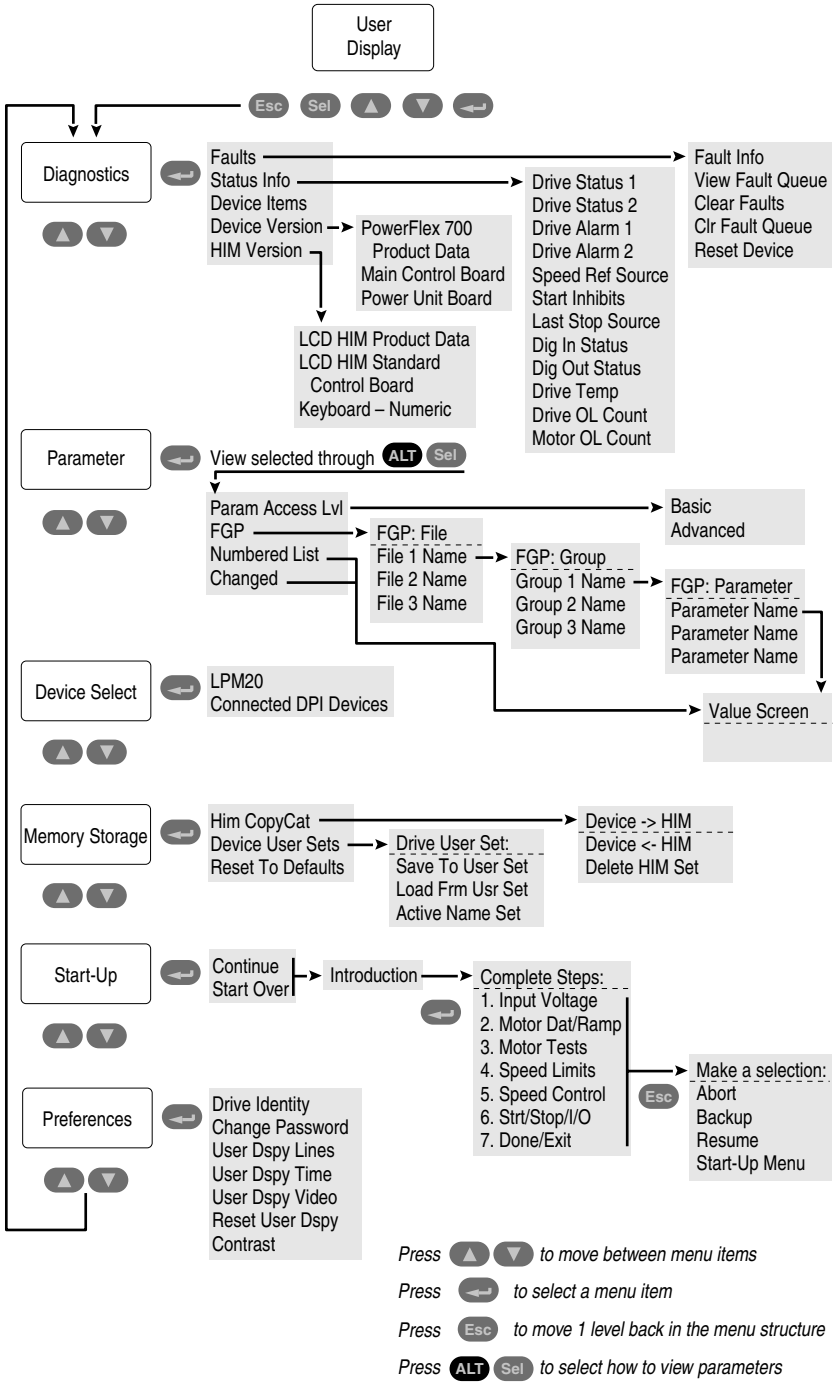
To use an ALT function, press the ALT key, release it, then press the programming key associated with one of the following functions:

Table B.A ALT Key Functions

ALT Key and then …			Performs this function …
ALT	Esc	S.M.A.R.T.	Displays the S.M.A.R.T. screen.
	Sel	View	Allows the selection of how parameters will be viewed or detailed information about a parameter or component.
	▲	Lang	Displays the language selection screen.
	▼	Auto / Man	Switches between Auto and Manual Modes.
	↵	Remove	Allows HIM removal without causing a fault if the HIM is not the last controlling device and does not have Manual control of the drive.
	.	Exp	Allows value to be entered as an exponent.
	+/–	Param #	Allows entry of a parameter number for viewing/editing.

Menu Structure

Figure B.2 HIM Menu Structure



Diagnostics Menu

When a fault trips the drive, use this menu to access detailed data about the drive.

Option	Description
Faults	View fault queue or fault information, clear faults or reset drive.
Status Info	View parameters that display status information about the drive.
Device Version	View the firmware version and hardware series of components.
HIM Version	View the firmware version and hardware series of the HIM.

Parameter Menu

Refer to Viewing and Editing Parameters on page B-5.

Device Select Menu

Use this menu to access parameters in connected peripheral devices.

Memory Storage Menu

Drive data can be saved to, or recalled from, User and HIM sets.
User sets are files stored in permanent non-volatile drive memory.
HIM sets are files stored in permanent non-volatile HIM memory.

Option	Description
HIM Copycat Device -->HIM Device <-- HIM	Save data to a HIM set, load data from a HIM set to active drive memory or delete a HIM set.
Device User Sets	Save data to a User set, load data from a User set to active drive memory or name a User set.
Reset To Defaults	Restore the drive to its factory-default settings.

Start Up Menu

See Chapter 2.

Preferences Menu

The HIM and drive have features that you can customize.

Option	Description
Drive Identity	Add text to identify the drive.
Change Password	Enable/disable or modify the password.
User Dspy Lines	Select the display, parameter, scale and text for the User Display. The User Display is two lines of user-defined data that appears when the HIM is not being used for programming.
User Dspy Time	Set the wait time for the User Display or enable/disable it.
User Dspy Video	Select Reverse or Normal video for the Frequency and User Display lines.
Reset User Dspy	Return all the options for the User Display to factory default values.

The LPM20 drive is initially set to Basic Parameter View. To view all parameters, set [ParamAccessLevel] parameter to option 1 “Advanced”. The [ParamAccessLevel] parameter is not affected by the Reset to Defaults function.

Viewing and Editing Parameters

LCD HIM

Step	Key(s)	Example Displays
1. In the Main Menu, press the Up Arrow or Down Arrow to scroll to "Parameter."	▲ or ▼	
2. Press Enter. "FGP File" appears on the top line and the first three files appear below it.	↵	FGP: File Monitor Motor Control Dynamic Control
3. Press the Up Arrow or Down Arrow to scroll through the files.	▲ or ▼	
4. Press Enter to select a file. The groups in the file are displayed under it.	↵	FGP: Group Metering Control Status Drive Data
5. Repeat steps 3 and 4 to select a group and then a parameter. The parameter value screen will appear.		
6. Press Enter to edit the parameter.	↵	FGP: Parameter % Motor Flux Output Freq Output Power
7. Press the Up Arrow or Down Arrow to change the value. If desired, press Sel to move from digit to digit, letter to letter, or bit to bit. The digit or bit that you can change will be highlighted.	▲ or ▼	
8. Press Enter to save the value. If you want to cancel a change, press Esc.	Sel	
9. Press the Up Arrow or Down Arrow to scroll through the parameters in the group, or press Esc to return to the group list.	↵	FGP: Par 310 Output Freq 60.00 Hz -250.00 <> 250.00
	▲ or ▼	
	Esc	FGP: Par 310 Output Freq 90.00 Hz -250.00 <> 250.00

Numeric Keypad Shortcut

If using a HIM with a numeric keypad, press the ALT key and the +/– key to access the parameter by typing its number.

Removing/Installing the HIM

The HIM can be removed or installed while the drive is powered.

Important: HIM removal is only permissible in Auto mode. If the HIM is removed while in Manual mode or the HIM is the only remaining control device, a fault will occur.

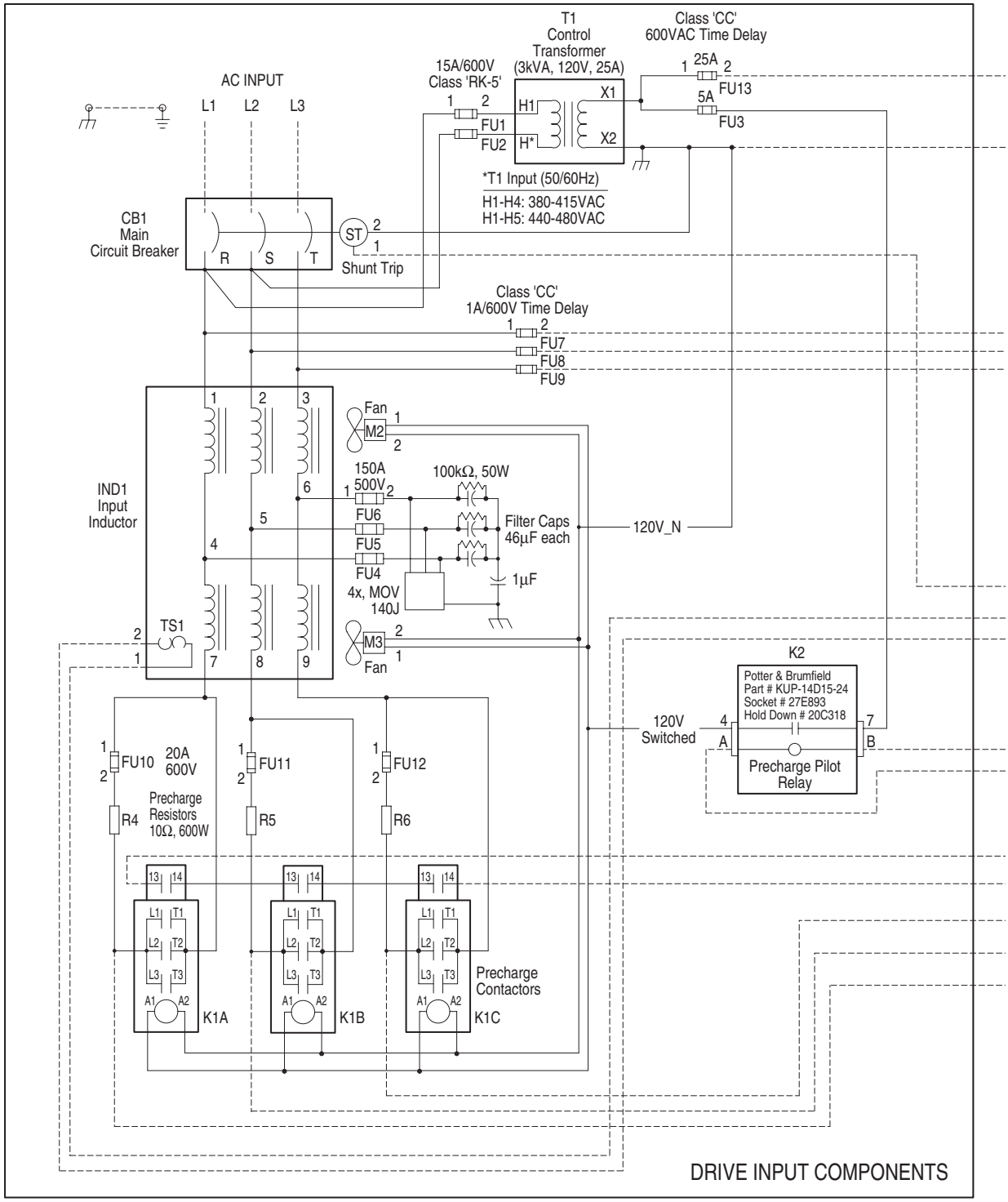
Step	Key(s)	Example Displays
To remove the HIM … 1. Press ALT and then Enter (Remove). The Remove HIM confirmation screen appears. 2. Press Enter to confirm that you want to remove the HIM. 3. Disconnect the HIM from the drive. To install HIM … 1. Connect the HIM cable to the drive (DPI Port 4). See Figure B.1.	ALT + ↵	Remove Op Intrfc: Press Enter to Disconnect Op Intrfc? (Port 1 Control)

Wiring Diagrams

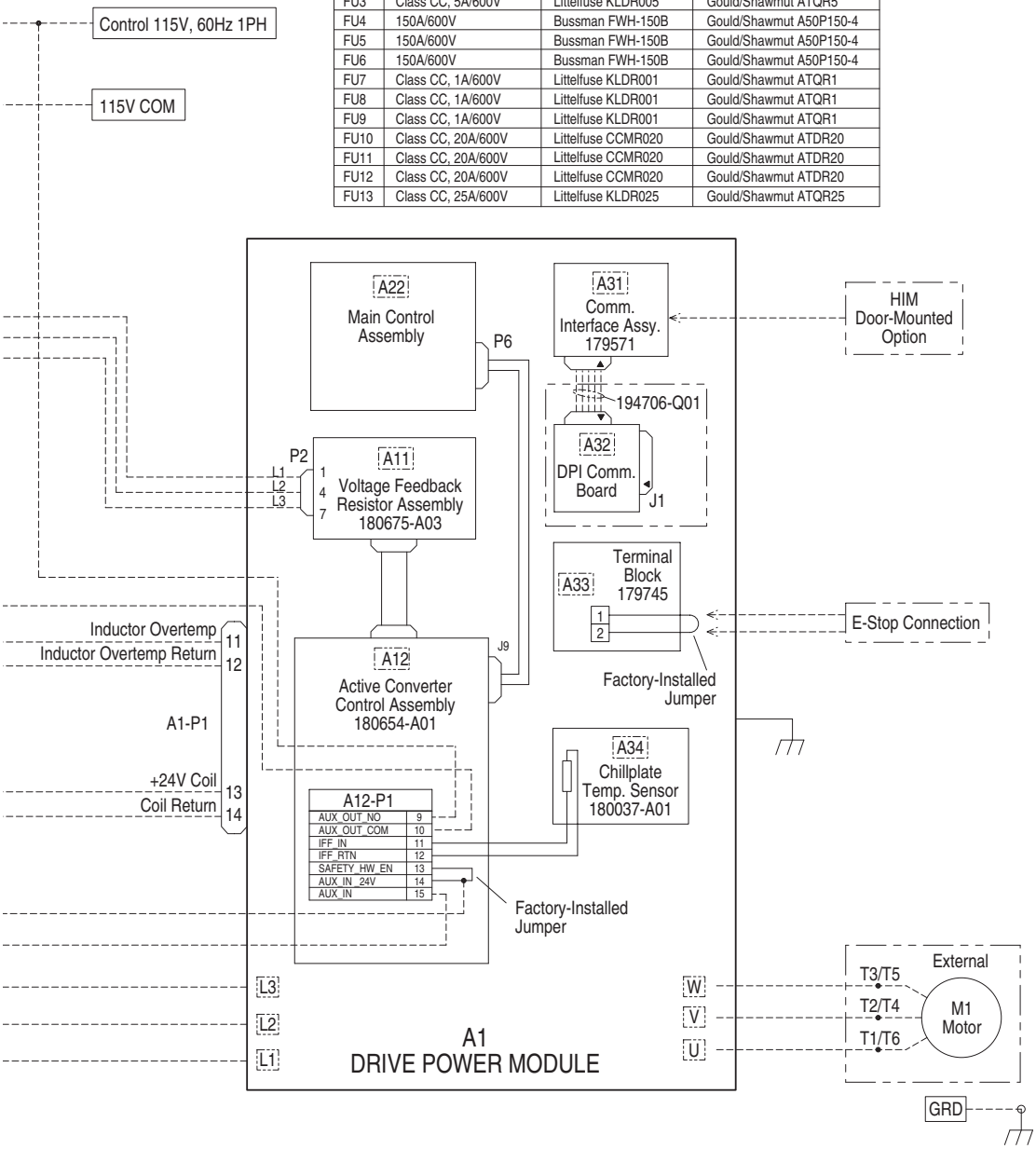
Wiring diagrams on the following pages illustrate the drive and power module wiring.

For information on ...	See page ...
Drive	C-2
Power Module – Overall	C-4
Power Module – Active Converter Control and Rectifier Power Interface	C-6
Power Module – High Voltage Interconnect and Inverter Power Interface	C-8
Power Module – Rectifier IGBT and Inverter IGBT	C-10

Drive


T1
Control
Transformer
(3kVA, 120V, 25A)
Class 'CC'
600VAC Time Delay
15A/600V
Class 'RK-5'
AC INPUT
L1
L2
L3
H1
H*
X1
X2
25A
FU13
5A
FU3
FU1
FU2
*T1 Input (50/60Hz)
H1-H4: 380-415VAC
H1-H5: 440-480VAC
CB1
Main
Circuit Breaker
R
S
T
ST
Shunt Trip
Class 'CC'
1A/600V Time Delay
FU7
FU8
FU9
IND1
Input
Inductor
Fan
M2
150A
500V
100kΩ, 50W
FU6
FU5
FU4
Filter Caps
46μF each
1μF
4x, MOV
140J
120V_N
TS1
M3
Fan
K2
Potter & Brumfield
Part # KUP-14D15-24
Socket # 27E893
Hold Down # 20C318
120V
Switched
Precharge Pilot
Relay
FU10
20A
600V
FU11
FU12
Precharge
Resistors
10Ω, 600W
R4
R5
R6
Precharge
Contactors
K1A
K1B
K1C
DRIVE INPUT COMPONENTS

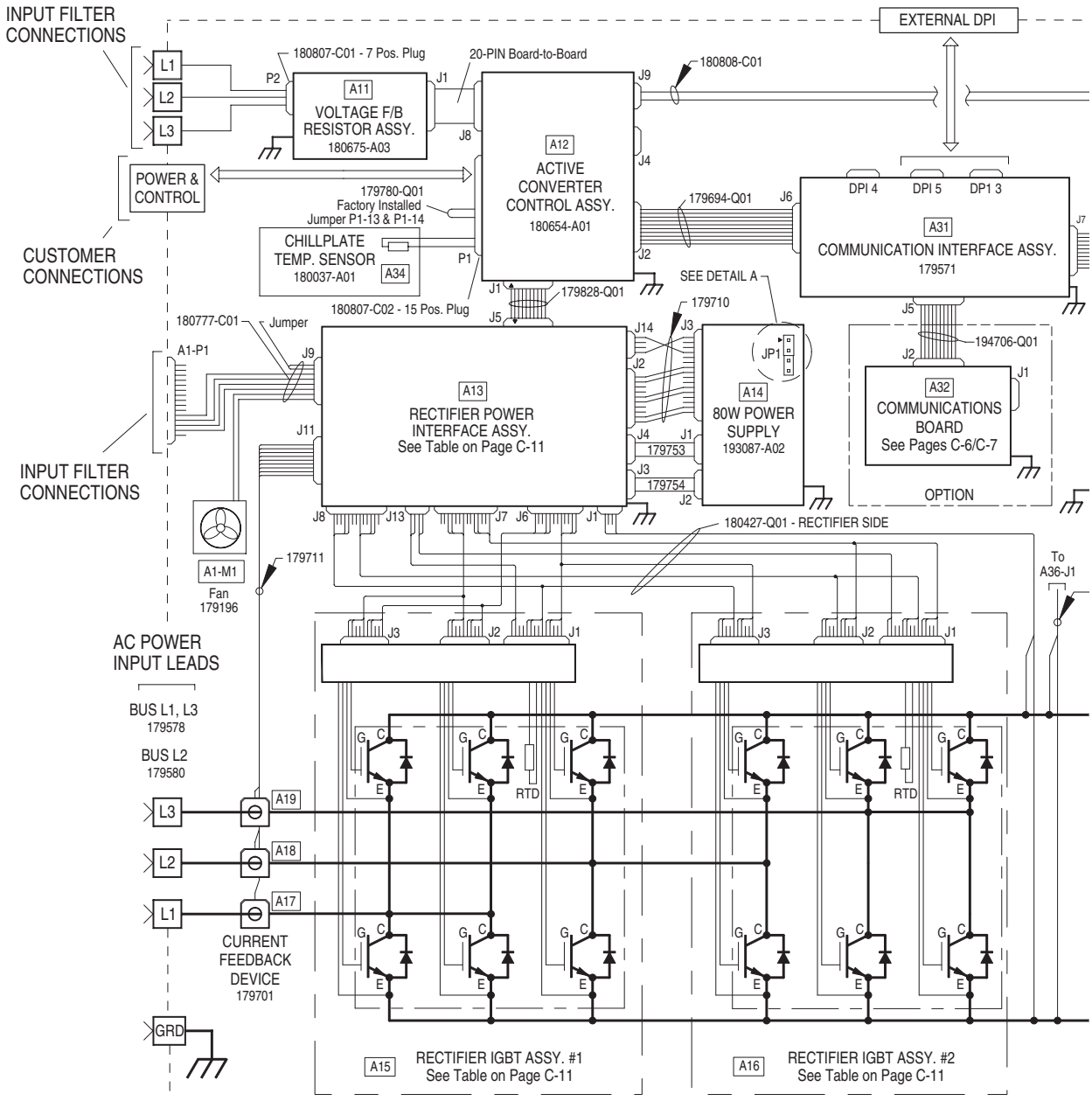
FUSE TABLE - DRIVE INPUT			
Ref.	**Fuse Description**	**Supplier "A" and P/N**	**Supplier "B" and P/N**
FU1	Class RK-5, 15A/600V	Bussman FRS-R-15	Gould/Shawmut TRS-R15
FU2	Class RK-5, 15A/600V	Bussman FRS-R-15	Gould/Shawmut TRS-R15
FU3	Class CC, 5A/600V	Littelfuse KLDR005	Gould/Shawmut ATQR5
FU4	150A/600V	Bussman FWH-150B	Gould/Shawmut A50P150-4
FU5	150A/600V	Bussman FWH-150B	Gould/Shawmut A50P150-4
FU6	150A/600V	Bussman FWH-150B	Gould/Shawmut A50P150-4
FU7	Class CC, 1A/600V	Littelfuse KLDR001	Gould/Shawmut ATQR1
FU8	Class CC, 1A/600V	Littelfuse KLDR001	Gould/Shawmut ATQR1
FU9	Class CC, 1A/600V	Littelfuse KLDR001	Gould/Shawmut ATQR1
FU10	Class CC, 20A/600V	Littelfuse CCMR020	Gould/Shawmut ATDR20
FU11	Class CC, 20A/600V	Littelfuse CCMR020	Gould/Shawmut ATDR20
FU12	Class CC, 20A/600V	Littelfuse CCMR020	Gould/Shawmut ATDR20
FU13	Class CC, 25A/600V	Littelfuse KLDR025	Gould/Shawmut ATQR25



NOTES:

1.) Dashed lines indicate wiring by others.

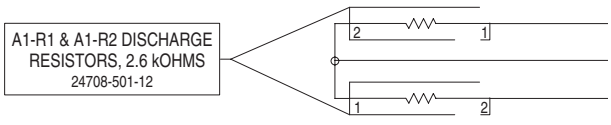
Power Module – Overall

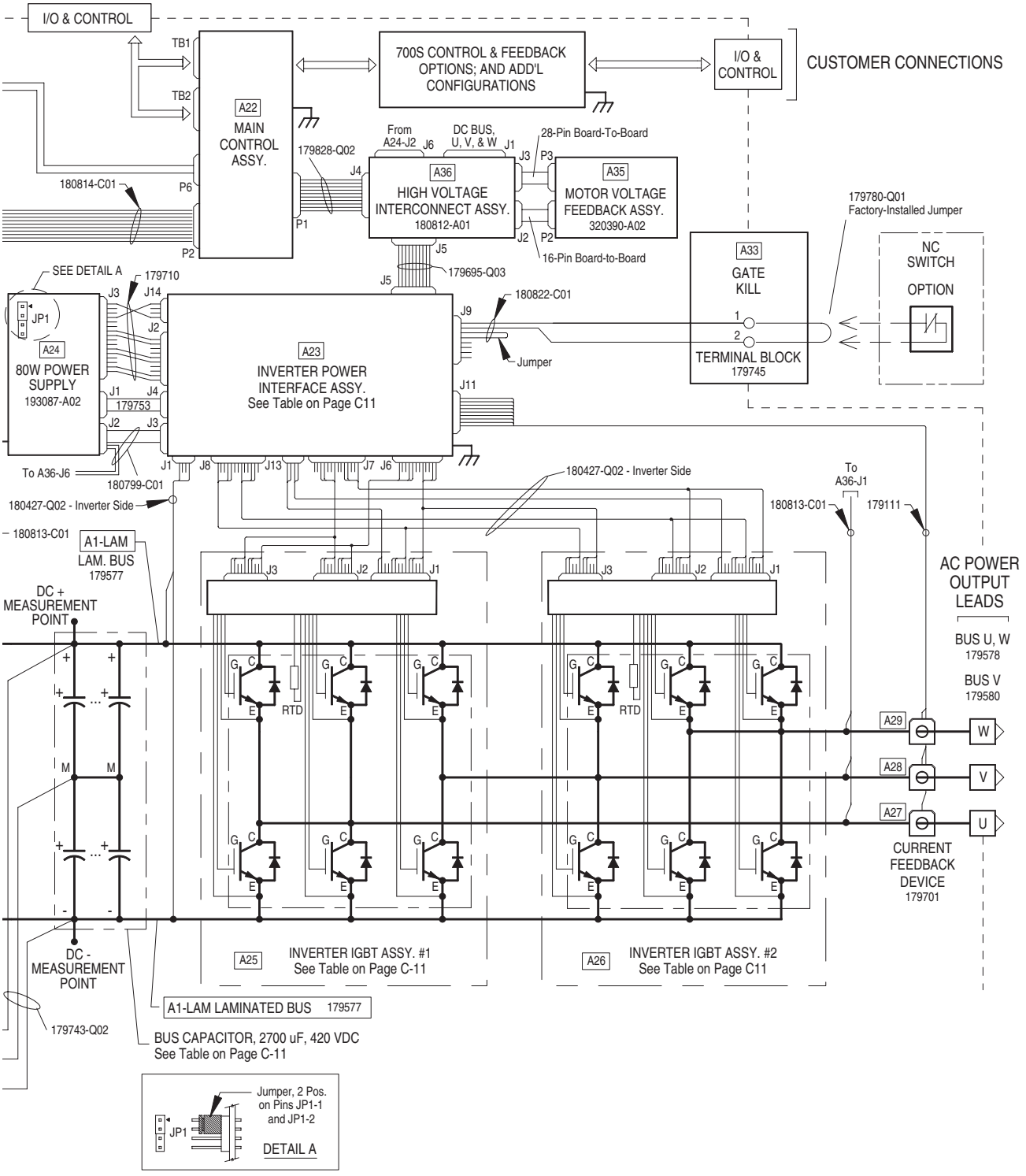


NOTES:

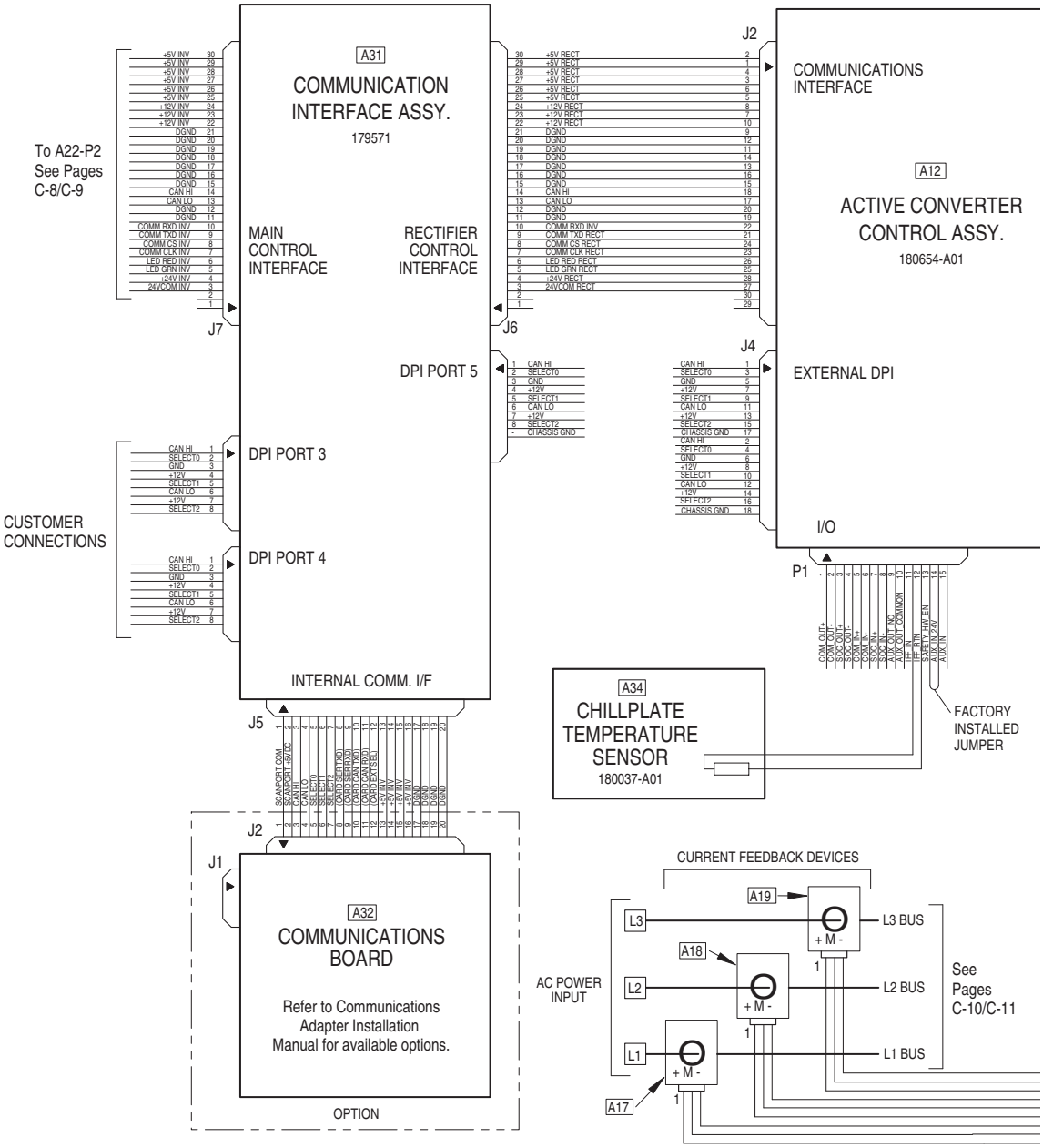
1.) See Table on Page C-11 for A1 VFD Power Module Model and component numbers.

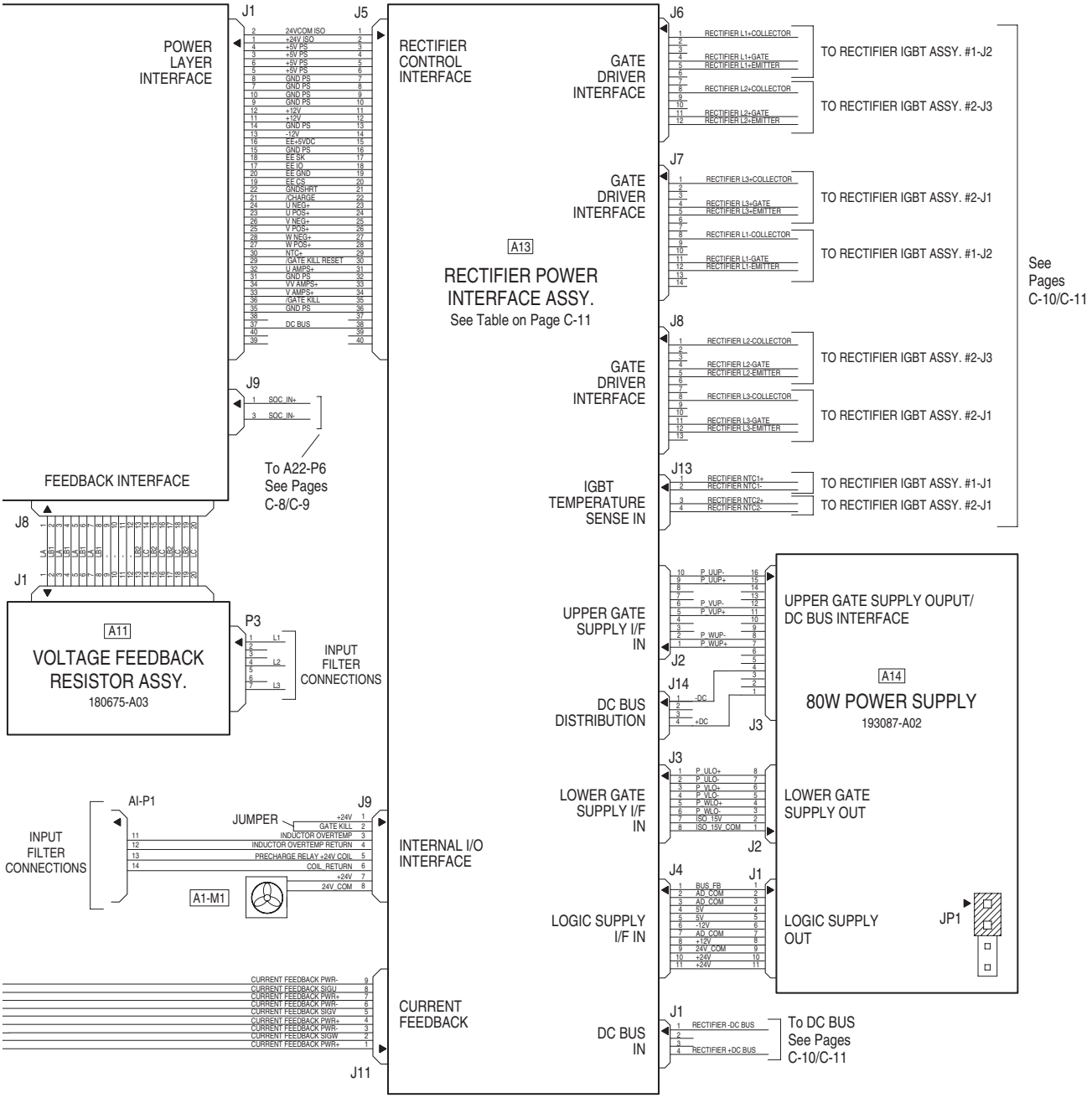
2.) See Pages C-6/C-7, C-8/C-9, and C-10/C-11 for PC board pin designators and signal names.



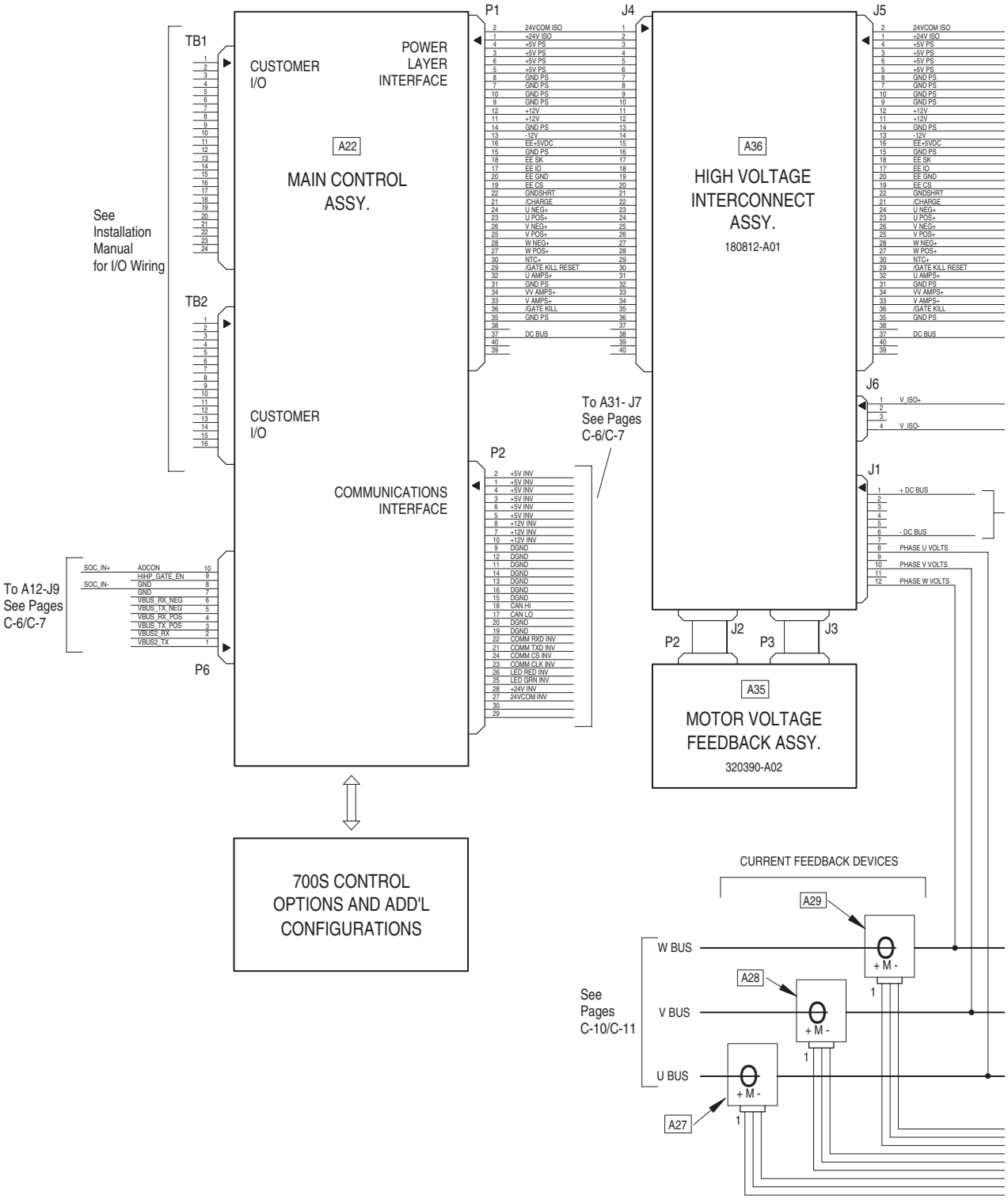

I/O & CONTROL
TB1
TB2
A22
MAIN CONTROL ASSY.
P6
P2
P1
180814-C01
700S CONTROL & FEEDBACK OPTIONS; AND ADD'L CONFIGURATIONS
I/O & CONTROL
CUSTOMER CONNECTIONS
From A24-J2
J6
DC BUS, U, V, & W
J1
28-Pin Board-To-Board
J3
P3
179828-Q02
J4
A36
HIGH VOLTAGE INTERCONNECT ASSY.
180812-A01
A35
MOTOR VOLTAGE FEEDBACK ASSY.
320390-A02
J2
P2
16-Pin Board-to-Board
J5
179695-Q03
179780-Q01
Factory-Installed Jumper
A33
GATE KILL
1
2
TERMINAL BLOCK
179745
NC SWITCH OPTION
SEE DETAIL A
179710
J3
J14
JP1
J2
A24
80W POWER SUPPLY
193087-A02
J1
J4
179753
J2
J3
A23
INVERTER POWER INTERFACE ASSY.
See Table on Page C11
J9
180822-C01
Jumper
J11
To A36-J6
180799-C01
J1
J8
J13
J7
J6
180427-Q02 - Inverter Side
180427-Q02 - Inverter Side
To A36-J1
180813-C01
179111
180813-C01
A1-LAM
LAM. BUS
179577
AC POWER OUTPUT LEADS
BUS U, W
179578
BUS V
179580
DC + MEASUREMENT POINT
J3
J2
J1
G
C
E
RTD
A29
W
A28
V
A27
U
CURRENT FEEDBACK DEVICE
179701
M
DC - MEASUREMENT POINT
A25
INVERTER IGBT ASSY. #1
See Table on Page C-11
A26
INVERTER IGBT ASSY. #2
See Table on Page C11
A1-LAM LAMINATED BUS 179577
179743-Q02
BUS CAPACITOR, 2700 uF, 420 VDC
See Table on Page C-11
Jumper, 2 Pos. on Pins JP1-1 and JP1-2
JP1
DETAIL A

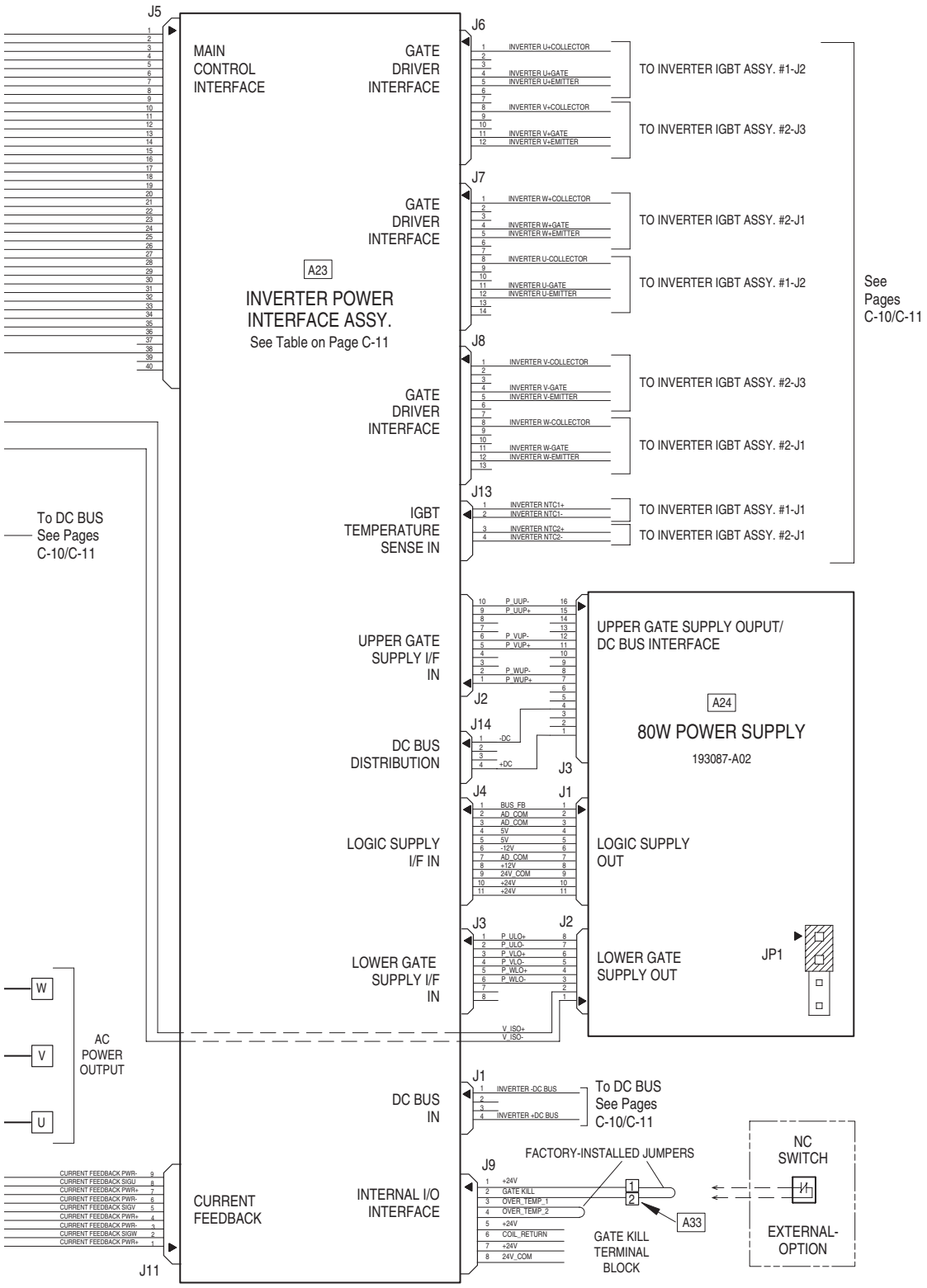
Power Module – Active Converter Control and Rectifier Power Interface



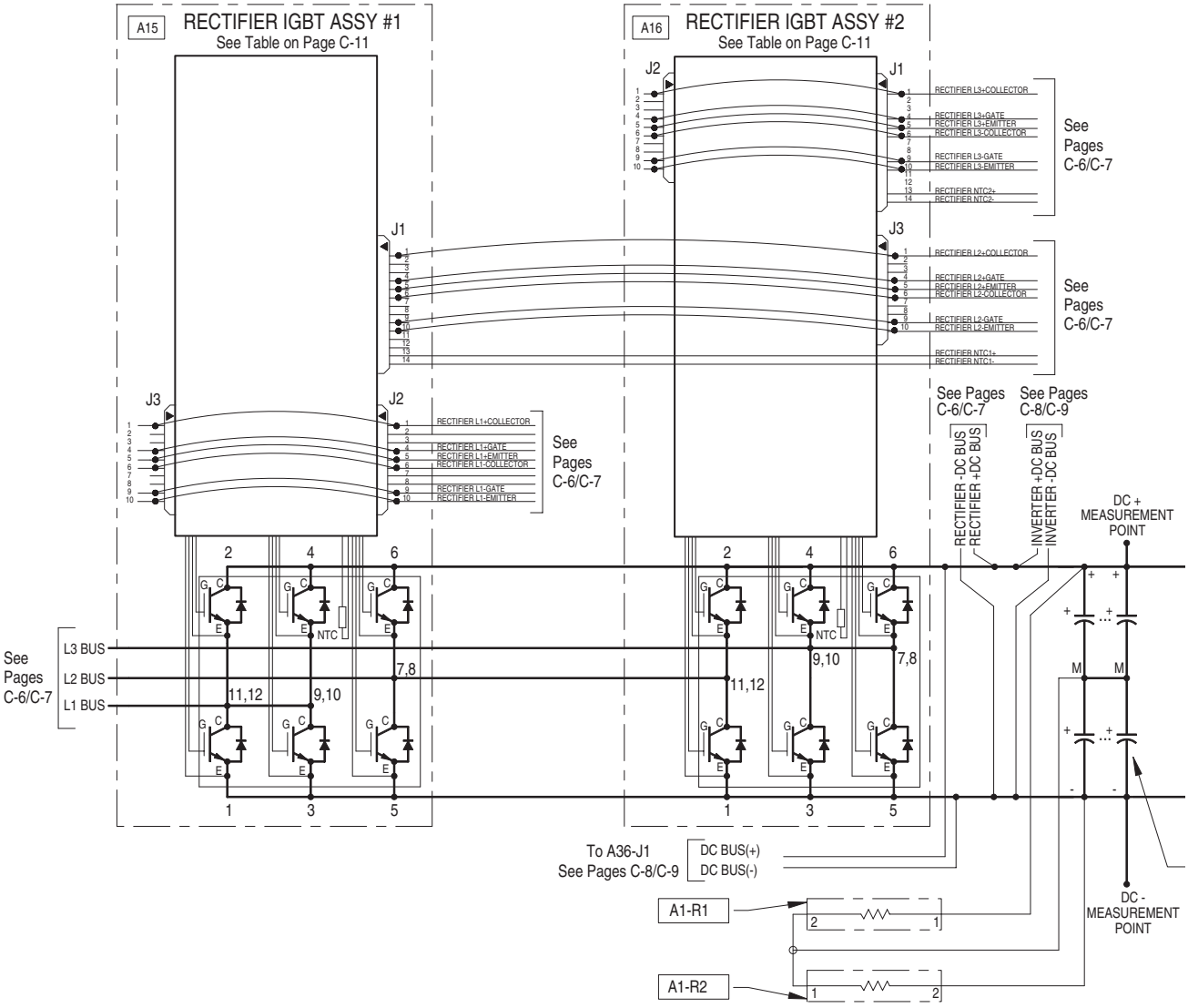

POWER LAYER INTERFACE
J1
J5
RECTIFIER CONTROL INTERFACE
GATE DRIVER INTERFACE
J6
RECTIFIER L1+COLLECTOR
RECTIFIER L1+GATE
RECTIFIER L1+EMITTER
RECTIFIER L2+COLLECTOR
RECTIFIER L2+GATE
RECTIFIER L2+EMITTER
TO RECTIFIER IGBT ASSY. #1-J2
TO RECTIFIER IGBT ASSY. #2-J3
J7
RECTIFIER L3+COLLECTOR
RECTIFIER L3+GATE
RECTIFIER L3+EMITTER
RECTIFIER L1-COLLECTOR
RECTIFIER L1-GATE
RECTIFIER L1-EMITTER
TO RECTIFIER IGBT ASSY. #2-J1
TO RECTIFIER IGBT ASSY. #1-J2
A13
RECTIFIER POWER INTERFACE ASSY.
See Table on Page C-11
J8
RECTIFIER L2-COLLECTOR
RECTIFIER L2-GATE
RECTIFIER L2-EMITTER
RECTIFIER L3-COLLECTOR
RECTIFIER L3-GATE
RECTIFIER L3-EMITTER
TO RECTIFIER IGBT ASSY. #2-J3
TO RECTIFIER IGBT ASSY. #2-J1
J13
RECTIFIER NTC1+
RECTIFIER NTC1-
RECTIFIER NTC2+
RECTIFIER NTC2-
IGBT TEMPERATURE SENSE IN
TO RECTIFIER IGBT ASSY. #1-J1
TO RECTIFIER IGBT ASSY. #2-J1
See Pages C-10/C-11
J9
SOC_IN+
SOC_IN-
To A22-P6
See Pages C-8/C-9
FEEDBACK INTERFACE
J8
J1
A11
VOLTAGE FEEDBACK RESISTOR ASSY.
180675-A03
P3
L1
L2
L3
INPUT FILTER CONNECTIONS
UPPER GATE SUPPLY I/F IN
P_UUP-
P_UUP+
P_VUP-
P_VUP+
P_WUP-
P_WUP+
J2
UPPER GATE SUPPLY OUPUT/ DC BUS INTERFACE
A14
80W POWER SUPPLY
193087-A02
J14
-DC
+DC
DC BUS DISTRIBUTION
J3
LOWER GATE SUPPLY I/F IN
P_ULO+
P_ULO-
P_VLO+
P_VLO-
P_WLO+
P_WLO-
ISO_15V
ISO_15V_COM
J2
LOWER GATE SUPPLY OUT
AI-P1
JUMPER
+24V
GATE KILL
INDUCTOR OVERTEMP
INDUCTOR OVERTEMP RETURN
PRECHARGE RELAY +24V COIL
COIL_RETURN
+24V
24V_COM
INPUT FILTER CONNECTIONS
A1-M1
INTERNAL I/O INTERFACE
J4
J1
BUS_FB
AD_COM
AD_COM
5V
5V
-12V
AD_COM
+12V
24V_COM
+24V
+24V
LOGIC SUPPLY I/F IN
LOGIC SUPPLY OUT
JP1
CURRENT FEEDBACK PWR-
CURRENT FEEDBACK SIGU
CURRENT FEEDBACK PWR+
CURRENT FEEDBACK PWR-
CURRENT FEEDBACK SIGV
CURRENT FEEDBACK PWR+
CURRENT FEEDBACK PWR-
CURRENT FEEDBACK SIGW
CURRENT FEEDBACK PWR+
CURRENT FEEDBACK
J11
J1
RECTIFIER -DC BUS
RECTIFIER +DC BUS
DC BUS IN
To DC BUS See Pages C-10/C-11

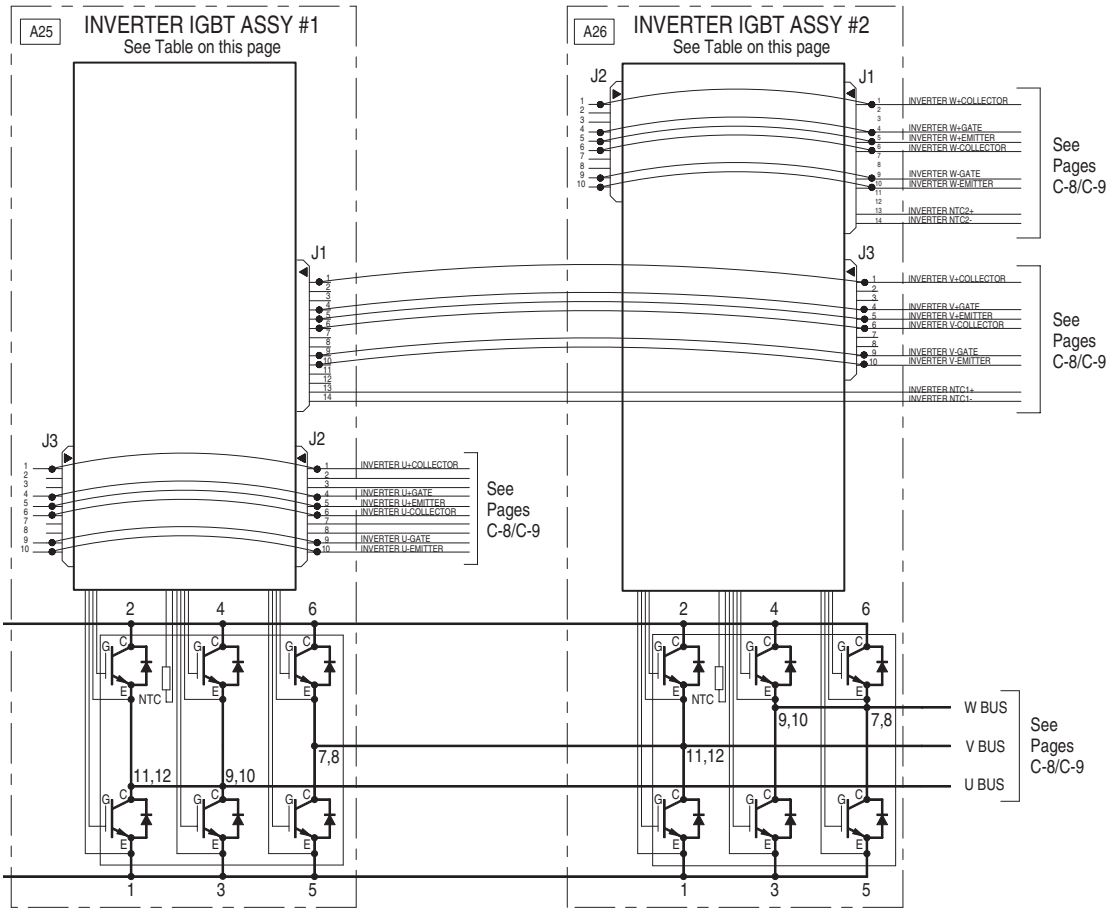
Power Module – High Voltage Interconnect and Inverter Power Interface




J5
MAIN CONTROL INTERFACE
GATE DRIVER INTERFACE
A23
INVERTER POWER INTERFACE ASSY.
See Table on Page C-11
J6
INVERTER U+COLLECTOR
INVERTER U+GATE
INVERTER U+EMITTER
INVERTER V+COLLECTOR
INVERTER V+GATE
INVERTER V+EMITTER
TO INVERTER IGBT ASSY. #1-J2
TO INVERTER IGBT ASSY. #2-J3
J7
INVERTER W+COLLECTOR
INVERTER W+GATE
INVERTER W+EMITTER
INVERTER U-COLLECTOR
INVERTER U-GATE
INVERTER U-EMITTER
TO INVERTER IGBT ASSY. #2-J1
TO INVERTER IGBT ASSY. #1-J2
J8
INVERTER V-COLLECTOR
INVERTER V-GATE
INVERTER V-EMITTER
INVERTER W-COLLECTOR
INVERTER W-GATE
INVERTER W-EMITTER
TO INVERTER IGBT ASSY. #2-J3
TO INVERTER IGBT ASSY. #2-J1
J13
INVERTER NTC1+
INVERTER NTC1-
INVERTER NTC2+
INVERTER NTC2-
TO INVERTER IGBT ASSY. #1-J1
TO INVERTER IGBT ASSY. #2-J1
IGBT TEMPERATURE SENSE IN
See Pages C-10/C-11
To DC BUS See Pages C-10/C-11
UPPER GATE SUPPLY I/F IN
P_UUP-
P_UUP+
P_VUP-
P_VUP+
P_WUP-
P_WUP+
J2
UPPER GATE SUPPLY OUPUT/ DC BUS INTERFACE
A24
80W POWER SUPPLY
193087-A02
DC BUS DISTRIBUTION
J14
-DC
+DC
J3
J4
J1
BUS_FB
AD_COM
AD_COM
5V
5V
-12V
AD_COM
+12V
24V_COM
+24V
+24V
LOGIC SUPPLY I/F IN
LOGIC SUPPLY OUT
J3
J2
P_ULO+
P_ULO-
P_VLO+
P_VLO-
P_WLO+
P_WLO-
LOWER GATE SUPPLY I/F IN
LOWER GATE SUPPLY OUT
JP1
V_ISO+
V_ISO-
W
V
U
AC POWER OUTPUT
J1
INVERTER -DC BUS
INVERTER +DC BUS
DC BUS IN
To DC BUS See Pages C-10/C-11
FACTORY-INSTALLED JUMPERS
NC SWITCH
J9
+24V
GATE KILL
OVER_TEMP_1
OVER_TEMP_2
+24V
COIL_RETURN
+24V
24V_COM
A33
GATE KILL TERMINAL BLOCK
EXTERNAL-OPTION
INTERNAL I/O INTERFACE
CURRENT FEEDBACK PWR-
CURRENT FEEDBACK SIGU
CURRENT FEEDBACK PWR+
CURRENT FEEDBACK PWR-
CURRENT FEEDBACK SIGV
CURRENT FEEDBACK PWR+
CURRENT FEEDBACK PWR-
CURRENT FEEDBACK SIGW
CURRENT FEEDBACK PWR+
CURRENT FEEDBACK
J11

Power Module – Rectifier IGBT and Inverter IGBT





A1 VFD POWER MODULE TABLE						
Model Number	A13	A15 A16	A23	A25 A26	Bus Capacitor Quantity	Bus Capacitor Part Number
20ND608...	179575	179527-A02	181023-A01	179527-A02	24	184698

Notes:

A

AC input
- ground, **1-13**
- wiring, **1-17**

AC supply, unbalanced or ungrounded, **1-11**

active converter assembly
- fault descriptions, **3-3**

agency certification, **A-1**

air flow clearance requirements, **1-10**

alarm
- clearing, **3-3**
- types, **3-1**

ALT key functions, **B-2**

armored cable, **1-20**

B

biocide use in coolant, **1-16**

bipolar inputs, **1-23**

bus capacitors, discharging, **P-4**

C

cables, power
- armored, **1-20**
- insulation, **1-20**
- separation, **1-20**
- shielded, **1-20**
- unshielded, **1-20**

capacitors - bus, discharging, **P-4**

catalog number explanation, **P-5**

checklist for drive start-up, **2-1**

clearance for air flow, **1-10**

clearing
- alarms, **3-3**
- faults, **3-3**

common mode interference, **1-23**

common symptoms/corrective actions, **3-4**

communication port, DPI, **1-7**

communications - programmable controller configurations, **A-3**

component locations for drive, **1-2**

contactors, input/output, **1-22**

control wire for I/O, **1-24**

conventions used in this manual, **P-3**

coolant
- biocide treatment, **1-16**
- connections to drive, **1-15**
- considerations, **1-14**
- corrosion inhibitor, **1-16**
- requirements, **1-15**

Copycat, **B-4**

D

data saving, **B-4**

diagnostic data, viewing, **B-3**

distribution systems, unbalanced or ungrounded, **1-11**

Dowtherm, **1-16**

DPI communication port, **1-7**, **B-1**

DPI port location, **1-7**, **B-1**

drive
- alarms and faults, **3-1**
- applying power, **2-1**
- component locations, **1-2**
- grounding, **1-13**
- lifting and mounting, **1-12**
- power loss watts rating, **1-13**
- power ratings, **1-1**
- start-up checklist, **2-1**
- status indicators, **2-3**, **3-2**

E

earthing, *see grounding*

Electrostatic Discharge (ESD), **P-4**

enclosure ratings, **1-2**

F

fault
- clearing, **3-3**
- descriptions for active converter, **3-3**
- descriptions for drive, **3-3**
- queue, **B-3**
- types, **3-1**

G

general precautions, **P-4**

grounding the drive, **1-13**

H

HIM
- Device User Sets, **B-4**
- diagnostics, **B-3**
- memory storage, **B-4**
- menu structure, **B-3**
- preferences, setting, **B-4**
- removing/installing, **B-6**
- Reset to Defaults, **B-4**

I

I/O wiring, **1-23**
- TB1 Terminal examples, **1-26**
- TB2 Terminal examples, **1-29**

input
- contactors - start/stop, **1-22**
- current rating, **1-1**
- line branch circuit protection, **1-12**
- power conditioning, **1-11**
- power rating, **1-1**

installation - drive, total area required, **1-7**

L

LCD HIM menus, **B-3**

LEDs, drive status, **2-3**, **3-2**

Logic Command Word, **A-4**

Logic Status Word, **A-5**

M

manual conventions, **P-3**

menu structure, HIM, **B-3**

motor
- lead lengths, **A-2**
- overload protection, installing, **1-19**

mounting the drive, **1-12**

N

non-resettable fault, **3-1**

O

operator interface, **B-5**

output
- contactors - start/stop, **1-22**
- current rating, **1-1**
- wiring, installing, **1-19**

P

parameter
- changing/editing, **B-5**
- viewing, **B-5**

port, DPI type, **B-1**

power
- before applying, **2-1**
- cables/wiring, **1-20**
- conditioning, input, **1-11**
- loss watts rating, **1-13**
- ratings for drive, **1-1**
- wiring, installing, **1-18**

powering up the drive, **2-1**

precautions, general, **P-4**

programmable controller configurations, **A-3**

R

ratings, drive, **1-1**

reflected wave, **1-21**

repeated start/stop, **1-22**

replacement parts, **3-7**

required external/separate input disconnect, installing, **1-18**

Reset to Defaults using the HIM, **B-4**

S

saving data, **B-4**

setting HIM preferences, **B-4**

shielded cables, power, **1-20**

signal wire, **1-23**

specifications
- agency certification, **A-1**
- control, **A-2**
- electrical, **A-2**
- environment, **A-1**
- protection, **A-1**

start/stop, repeated, **1-22**

start-up checklist, **2-1**

static discharge (ESD), **P-4**

status indicators, **2-3**, **3-2**

SynchLink, **1-32**

system grounding, **1-13**

T

TB1 Terminals, **1-25**

TB2 Terminals, **1-28**
terminal block wire size
encoder - Main Control Board, **1-25**
I/O - Active Converter Control Board, **1-35**
I/O - Main Control Board, **1-25**
transformers and reactors, installing, **1-17**
troubleshooting, **3-1**

U

unbalanced/ungrounded supply, **1-11**
unshielded power cables, **1-20**
user configurable alarm, **3-1**

V

viewing and changing parameters, **B-5**

W

web site
ControlNet installation references, **P-2**
drive reference materials, **P-2**
DriveLogix5730 Controller, **P-2**
feedback devices, **P-2**
SynchLink Design Guide, **P-2**
wire
control, **1-24**
routing, **1-13**
signal, **1-23**
wiring
I/O, **1-23**
power, **1-20**
requirements for drive, **1-11**

U.S. Allen-Bradley Drives Technical Support - Tel: (1) 262.512.8176, Fax: (1) 262.512.2222, Email: support@drives.ra.rockwell.com, Online: www.ab.com/support/abdrives

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 20N-IN001D-EN-P – November, 2006
Supersedes 20N-IN001C-EN-P – July, 2005

P/N 180779-P04
Copyright © 2006 Rockwell Automation, Inc. All rights reserved. Printed in USA.